The *Conchoecia skogsbergi* species complex (Ostracoda, Halocyprididae) in the Atlantic Ocean

A. J. Gooday
Institute of Oceanographic Sciences, Wormley, Godalming, Surrey, U.K.

Introduction

The planktonic ostracod genus *Conchoecia* includes a heterogeneous array of 105 described species with at least another 15–20 recognized, but as yet undescribed (Angel, personal communication). The named species have been separated into a number of groupings (Müller, 1906*a*; Skogsberg, 1920). Some of these were given generic status by Granata & di Caporiacco (1949) and Poulsen (1973) but this nomenclature is not universally accepted because several of the genera appear to be unnatural units (Angel and Fasham, 1975 : 711). One of the more important, and probably natural, assemblages is the *rotundata* group (= *Metaconchoecia* Granata & di Caporiacco, 1949), which comprises 11 or 12 previously described species, most obviously united by the location of the left asymmetric gland in an anterior position, just behind the rostrum.

Although most of the *rotundata* group species are fairly well understood, two names, *C. rotundata* Müller, 1890 and *C. skogsbergi* Iles, 1953, have not been applied consistently. *C. rotundata* has been the subject of particular confusion. These long standing taxonomic problems have been compounded in recent years by Angel's recognition that '*C. rotundata*' in Atlantic *Discovery* material comprises an array of very similar 'forms' (Angel, 1972; 1979 : 68–73; Angel & Fasham, 1975 : 711). In the present paper, which is largely based on the same *Discovery* material, *C. rotundata* and *C. skogsbergi* are redescribed and eight new species are established. All but one of these ten species are embraced by Angel's '*C. rotundata* forms 1–15'. They together make up a closely related assemblage within the *rotundata* group which is referred to here as the *skogsbergi* complex.

It is obvious from material in other collections that many, perhaps all, of the *skogsbergi* complex species were seen by earlier workers. Understandably, they were usually identified as *C. rotundata* or, in more recent literature, as *C. skogsbergi*.

Materials and methods

Most of the material was collected by the RRS *Discovery* between 1968 and 1974 in the N. Atlantic at a series of stations situated approximately along the 20°W meridian between 60°N and the equator (Angel & Fasham, 1975) and also along a 32°N transect from Africa to Bermuda (Angel, 1979). With a few exceptions, these samples were taken with the RMT 1 component of the RMT 1 + 8 opening and closing net system which is able to sample discrete horizontal horizons within the water column (Baker, Clarke & Harris, 1973). The gear was usually fished at four depth horizons down to 100 m, then 100 m horizons down to 1000 m and broader bands between 1000 m and 2000 m, thus allowing reasonably precise data on the depth distribution of planktonic organisms to be obtained. Further details of sampling procedures with the RMT 1 + 8 are given elsewhere (Angel & Fasham, 1976; Badcock & Merrett, 1976; Angel, 1979). At *Discovery* Station 6665, a modified Indian Ocean Standard Net (N113) fitted with a catch dividing bucket (CDB, Foxton, 1963) was used. A smaller number of specimens from the S. Atlantic and the Atlantic sector of the Southern Ocean

Bull. Br. Mus. nat. Hist. (Zool.) **40** (4) : 137–209 Issued 30 July 1981

were collected by *Discovery* II between 1936 and 1938 with vertically hauled 70 cm nets (N70V). The station data are deposited in the library of the British Museum (Natural History). The *Discovery* material of Iles (1953), the remaining specimens of which have been reexamined, was collected from the RRS *William Scoresby* with N70V nets.

Some important museum material from the Atlantic, Indian, Pacific and Southern Oceans, including specimens studied by G. W. Müller, Skogsberg, Fowler and Poulsen, was reexamined. However, a comprehensive examination of all relevant material in other collections was not attempted. Details of this material are given below and in Tables 1 & 2 and Appendix 1. The following abbreviations are used when referring to examined specimens:

BM(NH)	–British Museum (Natural History), London.
DC, Wormley	–*Discovery* Collections, Institute of Oceanographic Sciences, Wormley, U.K.
NR, Stockholm	–Naturhistoriska riksmuseet, Stockholm, Sweden.
SI, Washington	–Smithsonian Institution, Washington, D.C., U.S.A.
ZIZM, Hamburg	–Universität Hamburg, Zoologisches Institut und Zoologisches Museum, Hamburg, Federal Republic of Germany.
ZM, Copenhagen	–Zoologisk Museum, Copenhagen, Denmark.
ZM, Berlin	–Zoologisches Museum, Berlin, German Democratic Republic.
S.A.E.	–Swedish 'Antarctic' Expedition 1901–1903.

In the laboratory, the ostracods were examined, measured and dissected under a Wild M5 Stereomicroscope. Mounted animals were examined under a Wild M15 microscope. Carapace outlines were executed with the aid of an M5 'Zeichentubus' and the line drawings of appendages with an M15 'Zeichentubus'. Carapace lengths and breadths were measured with the animal lying on its back. In the text, mean carapace lengths are given with their standard deviations. Potentially ambiguous measurements are defined by Gooday (1976 : 59).

The following abbreviations for morphological characters are used:

A1	First antenna
A2	Second antenna
Exl, 2 etc.	First, second etc. segment of exopodite
Enl, 2 etc.	First, second etc. segment of endopodite
LSS	Longest swimming seta
F.O.	Frontal organ
L	Carapace length
H	Carapace height
B	Carapace breadth
LAG	Left asymmetric gland
RAG	Right asymmetric gland

Historical Review

(i) *1890–1920. Conchoecia rotundata* was established by Müller (1890), in the earliest of his halocyprid papers, on the basis of a few specimens taken at a depth of 1000–4000 m of wire at two stations in the tropical Pacific. These specimens were up to 1·15 mm long. They were inadequately described and the species cannot now be recognized with any confidence, although its identity is speculated on below. A few years later, Müller (1894) gave a fuller

description of a smaller form (L = 0·80 mm) from the Mediterranean which had a more rounded lateral outline. The situation becomes further confused with Müller's (1906*a*) *Valdivia* report in which specimens of *C. rotundata,* collected over a wide area (40°N to 62°S in the Atlantic, Indian and Southern Oceans), were said to vary considerably in size and outline with height : length ratios of 4/7 (57·1%) to 8/19 (42·1%) and lengths of 1·40 mm to 1·75 mm for Antarctic specimens and 0·80 mm to 1·40 mm for those from warmer water. Müller (1906*a* : 83, pl. XVII, figs 23–26) distinguished two distinct carapace types in the *Valdivia* material, one long and elongate and the other relatively short and more rounded, the latter corresponding closely to the Mediterranean form (Müller, 1894) of *C. rotundata.* The same author gives additional records of *C. rotundata* in his *Siboga* and *Gauss* reports (Müller, 1906*b*, 1908) but in neither of these papers is the material described. The account of this species in Müllers (1912) comprehensive treatise on the Ostracoda is drawn from the description in the *Valdivia* report. It is shown below that Müller's *Gauss* and *Valdivia* specimens, at least, belong to a number of species and his published descriptions (Müllers, 1906*a*, 1912) of '*C. rotundata*' greatly oversimplify the nature of this material.

In an unorthodox but stimulating contribution to halocyprid taxonomy, Fowler (1909) recognized the taxonomic difficulties created by Müller's inclusion of two widely different forms in one species. Fowler believed both forms were present in his material from the Bay of Biscay and resolved the problem by regarding the elongate carapaces as adults (Stage I) and the short carapaces as penultimate instars (Stage II) of the same species. The Stage I instars had mean lengths of 1·0 mm (♂) and 1·1 mm (♀), the Stage II instars had mean lengths of 0·75 mm (♂) and 0·79 mm (♀) (Fowler, 1909 : 273). It is significant that these temperate specimens of the elongate form were markedly smaller than Müller's (1906*a*) elongate form from the Southern Ocean, a point returned to below.

This initial period of research ended when Skogsberg (1920) described 24 specimens of *C. rotundata* from the SW Atlantic, ranging in length from 1·45 mm to 1·60 mm (both sexes). These correspond well in size and lateral shape to Müller's (1906*a*) long form. With characteristic thoroughness, Skogsberg (1920) reviewed the *C. rotundata* problem and concluded that the long and short forms were distinct taxonomic entities, the short form, of which he had no material, perhaps being the same as *C. nasotuberculata* Müller, 1906, and the elongate form being closer to Müller's original concept of *C. rotundata.*

(ii) *Iles' contribution.* One of the key contributions was that of Iles (1953) who studied *Discovery* samples from the Benguela Current in the SE Atlantic. In many of these samples, Iles identified both adults and juveniles of the long and short forms of *C. rotundata* as well as *C. nasotuberculata.* Iles noted that the long and short forms in his material were morphologically quite distinct and also had different depth distributions. He therefore concluded that Skogsberg (1920) had been correct in suspecting that the long and short forms of Müller (1906*a*) and Fowler (1909) were separate species. Iles believed that the short form was conspecific with the Mediterranean *C. rotundata* of Müller (1894) because of its similar size (L = 0·80–0·90 mm) and lateral carapace outline. In addition, he pointed out that despite Müller's (1890) inadequate description, there were sufficient differences between the short form and Müller's original concept of *C. rotundata* to justify describing it as a distinct species, *C. teretivalvata* Iles, 1953. A second new species, *C. skogsbergi*, was erected for the long form, which clearly differed in size and lateral outline from the original *C. rotundata.* However, Iles (1953) did not describe the Benguela Current material of *C. skogsbergi* but referred to Skogsberg's (1920) account of *C. rotundata* from the SW Atlantic as the type description. Following Iles (1953) report, *C. rotundata* was then left as the name of a valid but unrecognizable taxon which included only Müller's (1890) specimens.

(iii) *1967 onwards.* Despite the unresolved nature of *C. rotundata,* the taxonomic legacy left by Skogsberg and Iles appeared to be fairly satisfactory in that two species, *C. skogsbergi* and *C. teretivalvata,* both previously identified as *C. rotundata,* were now clearly recognized as distinct and were adequately described. This was the situation when the lull in planktonic

ostracod studies, which followed the publication of Iles (1953) paper, was terminated in the late 1960s. During this most recent and continuing period of research, both of Iles (1953) species have been widely recognized. There are records of *C. skogsbergi* from the following high latitude areas in the northern hemisphere: the Norwegian Sea (Angel, 1968*a*), near the North Pole (Leung, 1972; 1973), the Bering Sea (Chavtur & Shornikov, 1974), the Okhotsk and Bering Seas and the Kurile-Kamchatka trench (Chavtur, 1976; 1977*a*; 1977*b*). In the Southern Ocean it has been recorded by Hillman (1967; 1968; 1969; as '*C. rotundata*') and Deevey (1974; 1978*b*). These recent, cold water, high latitude reports of *C. skogsbergi* are fairly convincing since where descriptions, or at least length data, are given, the specimens conform more or less closely to Skogsberg's (1920) definitive description.

C. skogsbergi has also been reported from warmer, temperate, and tropical waters but here the situation is more complex and probably none of these identifications is correct. Angel's recent studies of N. Atlantic *Discovery* material have revealed an array of undescribed ostracod species, closely related to *C. skogsbergi* but smaller, although generally larger than *C. teretivalvata.* Angel & Fasham (1975; see also Angel, 1972; 1977*a*; 1977*b*; 1979) distinguished 15 forms within this complex. In the present study, which is largely based on the same material, Angel's forms are placed in nine species, seven of them new. Some of these *skogsbergi* complex species are the same as those assigned by other authors to *C. rotundata* or low latitude forms of *C. skogsbergi.* The male *C. rotundata* long form of Fowler (1909: pl. 24, fig. 205) belongs to Angel & Fasham's (1975) form 3 while the smaller, warmer water variety of *C. skogsbergi* reported by Deevey (1968; 1974; 1978*a*) from the Sargasso Sea, the Atlantic between 30°S and 35°S and from off Venezuela, is at least in part equivalent to forms 1, 5 and 13. From the same area Deevey (1968) described, as *C. rotundata,* a small form which also belongs to this complex (form 15). The rather different species from the W. Atlantic and tropical Pacific assigned to *C. rotundata* by Poulsen (1973), is close to form 4. Another species, said to be distinct from both *C. skogsbergi* and *C. teretivalvata,* was reported by George (1969) and George, Purushan & Madhupratap (1975) from the NW Indian Ocean but was not described and so cannot be assessed; the same comment applies to *C. rotundata* of Chavtur (1977*a*) from the subtropical Pacific.

The *C. rotundata* material of G. W. Müller

Several fairly large collections of G. W. Müller's material still exist (Athersuch, 1976). During this study, animals collected by the *Valdivia* (Deutsche Tiefsee-Expedition 1898–1899; 642 specimens: see Müller, 1906*a*) and the *Gauss* (Deutsche Süd-Polar Expedition, 1901–1903; 617 specimens: see Müller, 1908), and identified by Müller as *C. rotundata,* were examined. These specimens are from the Atlantic, Southern and Indian Oceans. None are from the Pacific. It was not possible to examine the Bay of Naples samples (Müller, 1894) mentioned by Athersuch (1976). The *Valdivia* and *Gauss* material is all preserved in alcohol. In general, the *Valdivia* specimens are poorly preserved with the valves widely splayed, often making identification impossible, or at best tentative. The *Gauss* material is generally in better, often surprisingly good condition and most specimens can be identified.

The 20 or so species found in these samples are listed in Tables 1 and 2 and Appendix 1. About half of them (*C. brachyaskos* Müller, 1906, *C. elegans* Sars, 1865, *C. hyalophyllum* Claus, 1890, *C. kyrtophora* Müller, 1906, *C. macrochiera* Müller, 1906, *C. macromma* Müller, 1906, *C. nasotuberculata, C. procera* Müller, 1894, *C. pseudoparthenoda* Angel, 1971 (very close to *C. parthenoda* Müller, 1906) and *C. spinirostris* Claus, 1974) are each represented by only a few specimens and were probably simply misidentified by Müller. The remainder comprise *C. arcuata* Deevey 1978, *C. rotundata* sensu Deevey, 1968, *C. skogsbergi, C. teretivalvata* and five of the new species described herein, all of which were presumably embraced by Müller's understanding of *C. rotundata.* These nine species, although closely related, differ from each other to varying degrees and in some cases are rather strikingly different (for example *C. skogsbergi* and *C. teretivalvata*). It is therefore

somewhat surprising that Müller was content to leave them unseparated. However, when examining his samples, for example the one from *Gauss* Station 12.11.01 which contains 196 specimens belonging to nine different species (Table 2), one senses that he was exasperated by the diversity of closely related species within '*C. rotundata*' and chose (Müller, 1906*a*, 1912) not to proceed beyond dividing this 'species' into long and short forms.

The present status of *C. rotundata* and *C. skogsbergi*

Following the historical review and the discussion of Müller's material, we are now in a position to consider how the names *C. rotundata* and *C. skogsbergi* are applied in this paper.

Müller's (1890) original description of *C. rotundata* includes the following taxonomically useful information. The carapace is moderately elongate and strongly tapered with the greatest height somewhat > half the length; the posterior end is strongly curved with the extremity at about half the height; the maximum breadth is somewhat < half the length; the length is up to 1·15 mm; the frontal organ capitulum is of somewhat variable shape; there are ten pairs of spines on the male first antenna e seta. Müller also illustrates a side view of the female carapace, the female second antenna endopodite, the male first antenna e seta armature and two male and two female frontal organ capitulums. As pointed out above, this information, together with the figures, is not sufficient to allow the species to be identified. However, it is possible to speculate. The lateral outline (Müller, 1890: pl. XXVIII, fig. 42) is reminiscent of several *skogsbergi* complex species, although less elongate than any of them. On the other hand, the outline is more elongate than in *C. kyrtophora, C. nasotuberculata* and *C. teretivalvata* and these three species are also smaller (< 1·0 mm) than the largest of Müller's (1890) specimens. The male e seta spines (pl. XXVIII, fig. 43) resemble these spines in the *skogsbergi* complex but are unlike those of *C. kyrtophora.* On the other hand, one of the female and one of the male frontal organ capitulums (pl. XXIX, figs 14a, d) are closely similar to the capitulum in *C. kyrtophora* and some related *rotundata* group species, while the other two capitulums (pl. XXIX, figs 14b, c) are more reminiscent of this structure in the *skogsbergi* complex species. It is therefore likely that Müller (1890) had at least two species in his material, perhaps *C. kyrtophora* and a species of the *skogsbergi* complex.

Müller's Pacific types of *C. rotundata* are presumed lost but, as discussed above, the *Gauss* and *Valdivia* material of this 'species' includes a variety of species, many of them belonging to the *skogsbergi* complex. None of this material is from the Pacific and it can therefore cast no direct light on the original identity of *C. rotundata.* However, it does demonstrate that Müller (1906*a*, 1908) had a very broad concept of *C. rotundata* when writing the *Valdivia* and *Gauss* reports and adds weight to the above suggestion that this species was originally polytypic.

Since there is no clear idea of what Müller (1890) meant by *C. rotundata,* the name is applied here in the sense of Deevey's (1968). There are, admittedly, some clear discrepancies between Deevey's species and Müllers (1890) original account of *C. rotundata.* Müller's specimens were considerably larger and the lateral outline, although similar, was relatively higher; also the male first antenna e seta (Müller, 1890: pl. XXVIII, fig. 43) had more spines (20). Several of the new *skogsbergi* complex species are closer to Müller's (1890) specimens in size and lateral outline and may be better candidates for this name. However, less confusion will be caused if the name is retained for Deevey's species which is now adequately described and well understood. This pragmatic approach is further justified by the presence of *C. rotundata* sensu Deevey in Müller's Gauss material.

C. skogsbergi presents rather different problems. As outlined above, Iles established the species after studying specimens from the Benguela Current which convinced him that the long form (*C. skogsbergi*) and the short form (*C. teretivalvata*) of *C. rotundata* were distinct species. However, Iles did not actually describe the Benguela specimens that he referred to *C. skogsbergi* but directed the reader to Skogsberg's (1920) description and figures which 'may

be taken as typical for this species'. This statement is followed by the sentence 'Type material will be deposited at the British Museum' (Iles, 1953 : 265), but in fact there are no specimens of *C. skogsbergi* in the BM(NH) collections. In July 1976, Dr Iles kindly sent me his remaining Benguela Current material of *C. skogsbergi.* It included a dissected male, mounted on two slides, each labelled 'type'. However, the slides did not have a catalogue number and were clearly not part of a museum collection.

Since the Benguela Current material was not described, since the type specimens selected from it were not deposited in a museum and since the type description was said to be Skogsberg's (1920) account of the long form of *C. rotundata,* the species should clearly be based on Skogsberg's material. I therefore obtained, through the courtesy of Dr R. Ölerod, Skogsberg's remaining material of *C. rotundata* in the Naturhistoriska riksmuseet, Stockholm, and selected a type specimen from it.

This procedure, apart from being nomenclaturally correct, has the advantage of basing *C. skogsbergi* firmly on a typical specimen from the SW Atlantic, rather than on the undescribed material of Iles (1953). In fact, Iles specimens have proved, on reexamination, to belong to another of the *skogsbergi* complex species and hence additional nomenclatural confusion has been avoided.

Taxonomic characters

For the purpose of routinely identifying planktonic ostracods, it is obviously an advantage if the important taxonomic characters are external features of the carapace, rather than appendage details which require dissection to be seen. It is therefore fortunate that in the *skogsbergi* complex, and probably in the genus *Conchoecia* as a whole, speciation seems always to be expressed morphologically in the size and shape of the carapace. The disposition and armature of the limb segments, and other internal features are, on the other hand, relatively conservative. With experience, and reasonable preservation, the species described here can therefore be recognized by their external morphology, although examination of the limbs is occasionally essential to confirm an identification. In this section, the taxonomically important carapace characters, and some less important internal characters, are discussed.

(i) *Carapace outline.* In material which is reasonably undistorted, species can usually be separated by consistent, although sometimes subtle, differences in their lateral and ventral outlines. In lateral view, particular attention should be paid to the relative height of the carapace, the way it tapers, the curvature of the posterior end and the position, above or below the mid-point, of the posterior extremity. In ventral view, the relative breadth of the carapace, the curvature of the sides and the shape of the anteroventral region, which may be sharply or bluntly pointed, are important. The ventral appearance of the carapace should always be illustrated. There is often some intraspecific variability in the carapace outline, for example in the degree to which specimens taper in lateral view. To show the range of variation, a series of carapaces are illustrated for each of the species described in the paper.

(ii) *Carapace length.* Certain closely related species of *Conchoecia* can be readily distinguished because their size ranges do not overlap (Angel, 1973; Gooday, 1976). This is not usually the case in the *rotundata* group, most species of which have overlapping size ranges. However, considering the *skogsbergi* complex by itself, two species do have characteristic carapace lengths: *C. rotundata* is consistently smaller, and *C. skogsbergi* is usually larger than other species. As shown below in the key, carapace length data may also be of value in separating similar species. Measurements of material spanning the known range of each species often reveal slight, geographically related size variations, lengths usually tending to decrease southwards. These complete data on the geographical variation in carapace length are available in tables stored in the BM(NH) library.

(iii) *Position of the left asymmetric gland.* In the *rotundata* group, the position of this gland varies from <9% (*C. nasotuberculata*) to >25% (*C. glandulosa* Müller, 1906, *C. macromma*) of the carapace length behind the tip of the rostrum, but does not uniquely characterize any of the species. Gland positions for the *skogsbergi* complex species are summarized in Table 9. In one of these species the gland is situated more posteriorly than in another member of the complex. The gland position may also be of value in discriminating between closely related species.

(iv) *Other morphometric characters.* The relative lengths of the frontal organ capitulum and the antennal segments and setae, expressed as percentages of the carapace length, have proved to be of taxonomic value in the genus *Conchoecia.* Within the *skogsbergi* complex, two species can be recognized using this character alone and pairs of species may also be separated in this way. However, the measurements are tedious and time consuming to obtain and although they may be used to confirm doubtful identifications, they are rarely of primary taxonomic importance.

(v) *Frontal organ capitulum.* This prominent structure is almost always described and illustrated in species descriptions and hence its usefulness as a taxonomic character needs to be considered. In the *rotundata* group it is of variable shape. The male capitulum of *C. glandulosa, C. kyrtophora, C. macromma, C. pusilla* Müller, 1906 and *C. nasotuberculata* is usually elongate, often slightly curved with a rounded, sometimes rather bulbous end. In the *skogsbergi* complex, and in *C. teretivalvata,* the male capitulum is relatively shorter and distally tapered, the ventral margin is clearly convex proximally and there is a corresponding, although less pronounced, concavity of the dorsal margin. In *C. isocheira* Müller, 1906 and *C. arcuata,* the male capitulum is rather similar to that of *skogsbergi* complex species. The female capitulum of *C. arcuata, C. isochiera, C. kyrtophora, C. macromma, C. nasotuberculata* and *C. pusilla* is not clearly delimited from the shaft, elongate, and rather bulbous distally, with a terminal spine in *C. macromma. C. glandulosa* has a similar, but more bulbous female capitulum. In the *skogsbergi* complex, and in *C. teretivalvata,* the female capitulum is more clearly delimited from the shaft, more or less tapered and the end pointed and downturned, or narrowly rounded and less clearly downturned. Hence, within the *rotundata* group, the shape of the capitulum may be characteristic of certain species, or species groupings.

Among members of the *skogsbergi* complex, the shape of the capitulum displays rather little interspecific variation. In males, the relative height may vary somewhat while the female capitulum is rounded in three species, pointed and clearly downturned in the remainder. Thus none of the species described in this paper has a characteristically shaped capitulum. Moreover, the shape sometimes varies within a species; this is particularly so in the case of *C. skogsbergi* (Figs 18, 19). For these reasons, the capitulum shape has very limited taxonomic value in the *skogsbergi* complex.

The number and the distribution of capitulum spines have been used as characters to separate *C. skogsbergi* and *C. rotundata* (Poulsen, 1973 : 73). However, the value of these spines as taxonomic characters was not confirmed during the present study.

(vi) *Armature of the male first antenna e seta.* This is another of the characters usually described by taxonomists. Among *rotundata* group species, *C. kyrtophora* is unique in having square ended spines lying at right angles to the seta (Angel, in press) and in *C. isochiera* the spines bear a single, distal row of 'moderately large, oval, hyaline appendage(s)' (Skogsberg, 1920 : 658). Müller (1912 : 62) used differences in the e seta armature to characterize these species in his key. All other members of the *rotundata* group have pointed, paired or staggered spines, lying almost flat against the seta. The number of these spines varies from 14 to 31 in the *skogsbergi* complex (Tables 5 & 13). However, the numbers show considerable overlap between species and are therefore of rather limited usefulness in taxonomy, although *C. rotundata* usually has fewer spines than the other members of the complex.

Key to the *Conchoecia rotundata* group (Figs 1–9, pp. 163, 171–174)

1. LAG > 20% of length behind tip of rostrum 2
   LAG < 20% of length behind tip of rostrum 4
2. Length usually < 1·25 mm (0·90–1·29 mm)* . . . . . ***macromma***
   Length usually > 1·25 mm 3
3. Anterior end curved and produced well forwards below rostrum; posterior end bluntly pointed where RAG opens above mid-point. L = 1·40–2·10 mm . . ***glandulosa***
   Anterior end not produced forwards; posterior end smoothly curved. L = 1·60–1·85 mm (♂); 1·38–1·55 mm (♀) . . . . . ***abyssalis***
4. Length > 1·30 mm . . . . . ***skogsbergi***
   Length < 1·30 mm 5
5. Carapace short and round in lateral view; H > 60% of length 6
   Carapace more cylindrical; H < 50% of length 8
6. Sides of carapace evenly curved in ventral view. L = 0·80–1·15 mm . . ***teretivalvata***
   Sides of carapace constricted behind insertions of A2 when viewed ventrally . . . 7
7. Carapace with lateral tubercles close to posterior dorsal corner. ♂ A1 e seta spines lie pointing dorsally, almost parallel to seta. LAG opens on rostrum, in front of anterior end of hinge . . . . . ***nasotuberculata***
   Carapace without tubercles. ♂ A1 e seta with spines set at right angles to seta. LAG opens just behind rostrum posterior to anterior end of hinge L = 0·72–1·0 mm . . ***kyrtophora***
8. RAG situated below posterior dorsal corner, opening at end of triangular process which makes distinct angle in upper part of posterior margin 9
   RAG opens near posterior dorsal corner, not on a process so that posterior margin of carapace appears smoothly curved 10
9. ♂ A1 e seta bears single row of 7–9 spines, each bearing a distal hyaline appendage. L = 0·80–1·00 mm (♂), 0·95–1·11 mm (♀) . . . . . ***isochiera***
   ♂ A1 e seta bears about 16 simple paired spines. L = 0·70–1·13 mm . . . ***pusilla***
10. Carapace with maximum height near middle, ventral margin arcuate; incisure tends to be deep and curved. ♂ A2 i and j setae with side branches. LAG > 15% of length behind tip of rostrum. L = 0·93–1·12 mm . . . . . ***arcuata***
    Carapace with maximum height nearer posterior end, lateral outline tapered with gently curved ventral margin; incisure tends to be fairly shallow. ♂ A2 i and j setae simple. LAG > 15% of length behind tip of rostrum in one species only 11
11. LAG > 15% of length behind tip of rostrum; in ventral view carapace narrow with B usually < 40% of length. On A1, b and d setae only slightly shorter than e seta. L = 0·95–1·18 mm . . . . . ***discoveryi*** sp.n.
    LAG < 15% of length behind tip of rostrum; except in one species, carapace wider in ventral view, with B consistently > 40% of length; ♂ A1 b and d setae markedly shorter than e seta 12
12. LAG usually 12%–15% of length behind tip of rostrum. Posterior end strongly and symmetrically rounded or slightly downturned; in ♂ B = 38–42% of length. L > 1·06 mm (1·10–1·40 mm) . . . . . ***fowleri*** sp. n.
    LAG perched above and just behind rostrum, < 12% of length behind tip; in ♂, B is always > 40% of length. Length < 1·20 mm 13
13. Carapace less strongly tapered, anteroventral region, below rostrum, is not sharply pointed in ventral view. Ventral outline not strongly biconvex. ♂ A1 e seta with 23–28 spines . 14
    Carapace more strongly tapered, anteroventral region, below rostrum, is pointed in ventral view. Ventral outline more strongly biconvex. ♂ A1 e seta with 14–26 spines . . . 15
14. L = 1·06–1·26 mm. Posterior end asymmetrically curved in lateral view with extremity below the mid-point . . . . . ***wolferi*** sp. n.
    L = 0·91–1·06 mm. Posterior end more symmetrically curved in lateral view with extremity around the mid-point . . . . . ***obtusa*** sp.n.
15. Carapace unusually broad in ventral view, particularly in ♀; B > 50% (♂), > 46·0% (♀) of length. Length = 0·97–1·16 mm . . . . . ***inflata*** sp.n.
    Carapace less broad in ventral view; except in one species, B < 50% (♂), < 46% (♀) of length 16

*Although Deevey (1974) gives lengths of 1·50 mm (♂), 1·27–1·40 mm (♀) for *C. macromma*.

16. Length <0·87 mm (♀), <0·83 mm (♂); ♂ A1 e seta with 14–18 spines . . . ***rotundata***
Length >0·87 mm (♀), >0·83 mm (♂); ♂ A1 e seta with 18–24 spines 17
17. Carapace height usually >50% of length; ♂ A1 LSS >60% of length, ♀ A2 LSS >47% of length. Length = 0·98–1·08 mm . . . . . ***australis*** sp.n.
Carapace height usually <50% of length; ♂A1 LSS <60% of length, ♀ A2 LSS <47% of length 18
18. Length = 0·95–1·20 mm. ♂ A2 f seta >40%, g seta >43% of length; ♀ A2 LSS >41% f–j setae >20% of length . . . . . ***subinflata*** sp.n.
Length = 0·85–1·01 mm. ♂A2 f seta <38%, g seta <42% of length; ♀ A2 LSS <41%, f–j setae <20% of length . . . . . ***acuta*** sp.n.

Systematic descriptions

Species of the *skogsbergi* complex show virtually no interspecific variation in the structure and setation of the mandible, maxilla, 5th, 6th and 7th limbs, labrum and caudal furca, or in the dentition of the mandibular tooth lists and cutting edge. The basic morphology of the first and second antenna in both sexes is also constant with only the proportional lengths of the main setae and segments (summarized in Tables 3, 4, 7, 8, 11, 12) and details of the setal armature (Tables 5, 13) varying between species. In the systematic section that follows, a complete account is therefore given only for *C. fowleri* sp. nov. and descriptions of other species are limited to those characters in which they differ morphologically from *C. fowleri* sp. nov. The description is not based on *C. skogsbergi* itself because the relatively large size and polytypic character of this species make it rather atypical of the *skogsbergi* group as a whole.

Most of the type material and other figured *Discovery* specimens are deposited in the BM(NH), under registration numbers 1979.690–827, 1980.141–145. There is also a collection of *Discovery* specimens of most of the described species deposited in the SI, Washington under registration numbers USNM 158124–158132. Museum specimens are undissected, except where otherwise stated. Dissected specimens are stained with lignin pink and mounted on slides in Euparal. Undissected specimens are preserved in 80% alcohol.

Conchoecia fowleri sp. nov.
(Figs 10–17, 18A–J, 19A–I)

Conchoecia rotundata Müller, 1890.—Müller, 1908 : 69–70 (in part).—Fowler, 1909 : 249–251 (in part), ? not pl. 23, figs 217 (? = *C. arcuata* Deevey, 1978), 206, 208–210, 212, 214, 216, 218, 220, 222, 224 (= ?), pl. 24, figs 205 (= *C. teretivalvata* Iles, 1953), 207 (= *C. subinflata* sp. nov.), 211, 213, 221, 223 (? = *C. pusilla* Müller, 1906), 215 (= ?), 219 (= *C. teretivalvata* Iles, 1953).

Conchoecia rotundata Müller, 1890, forms 1, 5, 9. Angel & Fasham, 1975 : 737 (distribution).—Angel, 1977*a* : 246 (vertical distribution). Not *Conchoecia rotundata* Müller, 1890.

Conchoecia skogsbergi Iles, 1953. Angel, 1968*b* : 308, Fig. 8 (vertical distribution).—Deevey, 1968 : 54–55, Figs 20a–d, 21a, d, f–h, 22a.—Angel, 1969 : 518, 539 (vertical distribution).—Deevey, 1974 : 364 (not Fig. 5b, = *C. skogsbergi* Iles, 1953).—Deevey, 1978*a* : 70. Not *Conchoecia skogsbergi* Iles, 1953.

ETYMOLOGY. Named after Dr G. H. Fowler, one of the first authors to work on planktonic ostracods from the NW Atlantic.

DIAGNOSIS. Lateral carapace outline elongate, rather gently tapered in anterior 2/3 to 3/4; posterior end symmetrically rounded, or slightly upturned. Length = 1·10–1·28 mm. Ventral carapace outline relatively narrow and weakly biconvex, in ♂ B = 38%–43% of length; anteroventral part of each valve not sharply pointed in ventral view. LAG usually lies 12%–15% of length behind tip of rostrum.

TYPE MATERIAL. Holotype: dissected ♂ (BMNH 1979.695). Paratypes: 2♀♀, dissected (BM(NH) 1979.696–697); 18♂♂, 21♀♀ (BM(NH) 1979.746–755).

TYPE LOCALITY. *Discovery* Station 7711, haul 32; 52°54·7′–52°56·5′N; 20°12·6′–20°7·7′W; depth 605–700 m; date 22 May 1971; time 2249–0049 hr; gear RMT 1.

OTHER MATERIAL EXAMINED. (i) Approximately 2500♂♂, 3500♀♀ and 5000JJ (DC Wormley). (ii) 21♂♂, 20♀♀ *Discovery* Station 7406, haul 44 (SI Washington, USNM 158126). (iii) 4♀♀, 2♂♂ in Fowler's (1908) material of *C. rotundata* (BM(NH) 1910.72.114). (iv) 1♀, *Valdivia* Station 182, in Müller's (1906*a*) material of *C. rotundata* (ZIZM, Hamburg K-18937; tentative identification). (v) 4♀♀, 4♂♂, *Gauss* Stations 19.10.01d, 12.11.01, 4.9.03, 30.9.03b, in Müller's (1908) material of *C. rotundata* (ZM, Berlin, 26476). (vi). 1♀, 1J, *Dana* Stations 3613–8, 3624–4, in Poulsen's (1973) material of *Metaconchoecia rotundata* (ZM, Copenhagen).

DESCRIPTION OF THE MALE. *Carapace* (Figs 10, 11A–S). In lateral view the ventral margin is almost straight or gently curved and joins the posterior end evenly. The dorsal margin is either straight or in the shape of a very broad V with the apex just behind the second antenna protopodite insertion; it joins the posterior end at a rounded angle. The rostral incisure is usually fairly shallow. In ventral view, the sides of the carapace are only gently curved. The right asymmetric gland opens near the posterodorsal corner. The left gland opens in an anterior position somewhat behind the incisure. There is no surface ornamentation.

Frontal organ (Figs 14F, 18A–J). The shaft does not extend beyond the end of the first antenna. In general, the proximal half of the capitulum is expanded, with a strongly convex ventral margin, and the distal part is slightly tapered or parallel sided. However, it is somewhat variable and may be narrower, parallel sided, with a strong proximal downflexure (Figs 18F, G, I). Stout ventral spines are developed, particularly on the proximal part.

First antenna (Figs. 14D, E). The segmentation is fairly distinct. Segment 2 bears fine lateral spines. The a seta extends back parallel to the limb, except proximally where it loops down and is rather expanded. The b seta is slightly shorter than the d seta and bears 5–11 closely spaced anterior spines, followed by 5–10 more widely spaced spines with 6–12 spines on the posterior side. The d seta has 8–15 anterior spines, followed by 2–6 more widely spaced spines. The e seta armature comprises 24–30 (mean 26·3, 56 observations) spines which lie at an acute angle to the seta and are paired or less commonly staggered.

Second antenna (Figs 14A–C). The protopodite bears a patch of short hairs behind En 1. Ex 1 has a short distal ventral seta and an area of proximal outer hairs. Posteriorly, En 1 bears 3 triangular ridges covered by fine hairs. The processes mamillaris is bulbous with a beak-like extension pointing slightly forwards. The right hook appendage is strongly developed with a long curved distal section and a number of subterminal ridges; the left hook appendage is smaller, with a short straight distal section and no subterminal ridges. The b seta is > twice the length of the a seta, the d seta is slightly shorter than the c seta and the e seta is a short spine. The f seta is rather longer than the g seta and on its anterior side bears 3–11 small spines; 2–3 spines are sometimes visible on the g seta.

Mandible (Figs 16B–E). The coxale cutting edge has a straight anterior section followed by 11–20 (usually 11–16) teeth. The distal list has a large pointed posterior tooth, followed by 18–26 small teeth. The proximal list has a large pointed, posterior tooth, 1–5 very small teeth, a second large tooth followed by 18–26 very small teeth, one of which, near the middle, is larger than the remainder; the inner surface of this list is covered with papillae. The cutting edge of the basale has two spine teeth, the posterior one pointed, the anterior one more rounded and both devoid of spines or hairs; these are followed by six serrated teeth of which the most posterior lacks secondary cusps. The anterior inner tooth is triangular with small serrations. Near the cutting edge of the basale there are two short setae inside the posterior margin, a longer seta on the anterior margin and a long median seta. The basale also has a long distal median seta below the endopodite. Ex 1 bears an outer distal plumose seta and two setae on the inner edge, one longer than the other. On Ex 2 there are three outer distal setae, one long, one of medium length and the other short, and two setae on the inner edge which are similar to those on Ex 1. Ex 3 has three outer setae, two long and claw like and the third short, and four short inner setae.

Maxilla (Fig. 16G). The anterior margin bears three long setae, of which the most proximal is the longest, and a rather shorter seta arising from just inside the margin. The posterior margin has three fairly long setae. The basal seta extends just beyond the end of the limb. There are 5–7 short spines on the bottom of the main segment.

Labrum (Fig. 16A). The hyaline membrane is interrupted by a deep V-shaped notch. On each side of the notch are 11–12 flaccid, inward facing teeth.

Fifth limb (Fig. 16F). Ex 1 bears seven ventral setae, two of these are posterior (distal), two are median and there are three smaller ones at the anterior end; there is also a long distal dorsal seta and a short lateral distal seta. Ex 2 has a medium sized ventral seta and a slightly longer dorsal seta. Ex 3 bears two fairly long claw-like setae and a shorter ventral seta.

Sixth limb (Fig. 14G). Ventrally, segment 1 bears three short posterior (distal) setae, two median setae, one of them short and the other longer and plumose, and two anterior (proximal) setae, one of them plumose. Segment 2 has a minute ventral seta which points out from the limb. Segment 3 has a minute ventral seta and a similar dorsal seta lying parallel to the limb. The terminal setae are fairly short and are armed with hairs only distally.

Seventh limb (Fig. 16I). The terminal segment bears two setae, one about three times the length of the other.

Caudal furca (Fig. 16H). There is an unpaired seta above the smallest claw seta. The claw setae are unusually straight.

Penis (Fig. 14H). The end of the penis is obliquely truncated. The terminal part of the vas deferens, which is narrow and tubular, lies free in a depression at the end of the penis; this depression is bounded posteriorly by a distinct lobe. There are 3–5 transverse muscles.

DESCRIPTION OF THE FEMALE. *Carapace* (Figs 12, 13A–O). The lateral outline has a more strongly rounded posterior end, but is otherwise like that of the male. In ventral view, the sides of the carapace are almost straight or only slightly curved.

Frontal organ (Figs 15E, 19A–I). The shaft extends well beyond the end of the first antenna and is about twice the combined length of segments 1 and 2. The capitulum is not differentiated from the shaft. It is rather expanded proximally and tapers to a narrowly rounded end. The dorsal surface is sometimes slightly concave near the middle; the ventral surface is usually slightly concave distally. In occasional specimens the end is more pointed and downturned.

First antenna (Figs 15C, D). Segment 2 is about twice the length of segment 1 and bears minute scattered lateral spines. The segmentation is fairly distinct. There is no dorsal seta. The a–d setae are almost twice the length of the e seta and are somewhat expanded beyond their basal stalk. The e seta bears 30–37 posterior spines, extending from near the distal end to just above the middle of the seta; the anterior side has 34–45 spines situated rather more proximally. The e seta tapers to a point and is not flattened.

Second antenna (Figs 15A, B). The armature of the protopodite, Ex 1 and En 2 is similar to that of the male, although the protopodite hairs and Ex 1 spines are not always visible. The a seta is about half the length of the b seta and both carry fine hairs. The c (or ?d) seta is minute and often not visible or absent. The f–g setae are rather > half the length of the protopodite and are devoid of armature.

Sixth limb (Fig. 15F). Segment 1 bears a plumose distal dorsal seta, four distal ventral setae, the longer two of which are plumose, two median ventral setae, the longer one plumose, and a plumose proximal ventral seta. Segment 2 has a single ventral seta. Segment 3 has a ventral median seta and a rather longer dorsal median seta. The terminal segment bears three claw setae, the median one is the longest and the dorsal seta is rather longer than the ventral seta.

DIMENSIONS. ♂ Carapace length: 1·10–1·28 mm, mean 1·21 ± 0·02 mm (n = 978). ♀: 1·12–1·28 mm, mean 1·21 ± 0·02 mm (n = 560). See Tables 3 & 4 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. Judging from the carapace outlines illustrated by Deevey (1968: Fig. 20a, b, 21a, d), her small form of *C. skogsbergi* from the W. Atlantic (Deevey, 1968; 1974; 1978*a*) is, at least in part, *C. fowleri*. However, the length range of Deevey's specimens extends down to 1·00 mm. This is well below the lower size limit of *C. fowleri* and suggests that she included at least one other species of the *skogsbergi* complex with *C. fowleri*.

One of the specimens figured by Fowler (1909 : 124, fig. 215) was identified by Angel, (1977*a*: Table 5) as *C. rotundata* form 1 (= *C. fowleri*). However, it cannot be *C. fowleri*, and in fact is impossible to assign to any *rotundata* group species, because it combines an elongate lateral outline with a left asymmetric gland which opens very near the tip of the rostrum.

GEOGRAPHICAL DISTRIBUTION. *Atlantic Ocean:* abundant in the E. Atlantic between 18°N, 25°W and 60°N, 20°W, less common at the equator and 11°N, 20°W (Angel & Fasham, 1975; Angel, 1977*a*; 1979); occasional specimens in *Gauss* samples from between 6°N and 35°S in the E. Atlantic (Table 2); in the W. Atlantic, fairly common around 32°N, 64°W (Deevey, 1968; Angel, 1979); probably present in the SW Atlantic and off Venezuela (Deevey, 1974; 1978*a*; as *C. skogsbergi*). *Indian Ocean:* single tentatively identified specimen in one *Valdivia* sample from E. Indian Ocean (Table 1). *Pacific Ocean:* two specimens in *Dana* material from the SW Pacific.

VERTICAL DISTRIBUTION. The overall range in the N. Atlantic is 400 m–1250 m; at 60°N, 20°W and 53°N, 20°W it is most common between 400 m and 700 m, further south around 18°N, 25°W and 11°N, 20°W it is most abundant at rather greater depths.

Conchoecia fowleri form A
(Figs 11T–Z, 13P–X, 17)

Conchoecia fowleri form 13.—Angel & Fasham, 1975 : 737.

MATERIAL. 26♀♀, 19♂♂, *Discovery* GATE Stations; 92♀♀, 38♂♂, Station 6665; 1♀, 8♂♂, 7089; 7♀♀, 1♂, 7824; 11♀♀, 6♂♂, 7803 (DC Wormley).

DESCRIPTION. This is a larger, deeper living variant of *C. fowleri*. The lateral outline is similar but in ventral view the carapace is broader than that of *C. fowleri* (Figs 11, 13). The male first antenna b, d and e setae, and the longest swimming seta on the female second antenna tend to be relatively longer.

DIMENSIONS. ♂ Carapace length: 1·28–1·40 mm, mean 1·33 ± 0·02 mm (n = 43). ♀: 1·28–1·38 mm, mean 1·32 ± 0·02 mm (n = 40). See Tables 3 & 4 for other morphometric data and Table 9 for left asymmetric gland position.

REMARKS. This form differs only slightly from typical specimens of *C. fowleri* and does not have a sufficiently distinct depth distribution to be regarded as a subspecies. The broad spectrum of length values for specimens taken at depths of 1000–1500 m near the equator, suggests that the two forms are hybridizing here (Fig. 17). Similar apparent hybridization was reported by Angel (1977*b*) in *C. elegans,* although Angel's forms were separated geographically, rather than by depth.

Conchoecia discoveryi sp. nov.
(Figs 20–22)

Conchoecia rotundata form 6 Angel & Fasham 1975 : 737 (distribution).—Angel, 1979 : 71–72, Figs 60, 61 (vertical distribution).

ETYMOLOGY. Named after RRS *Discovery.*

DIAGNOSIS. Lateral carapace outline gently tapered in anterior 2/3 to 3/4; posterior end usually somewhat upturned. Length = 0·95–1·18 mm. Ventral outline relatively narrow and weakly biconvex, in ♂ B usually <40% of length; anteroventral part of each valve not sharply pointed in ventral view. LAG lies more posteriorly than in other species of

skogsbergi complex, > 15% of length behind tip of rostrum. ♂ A1 e seta only slightly longer than b and d setae and relatively shorter than in other species of *skogsbergi* complex.

TYPE MATERIAL. Holotype: dissected ♂ (BM(NH) 1979.693). Paratypes: 1 dissected ♀ (BM(NH) 1979.694); 14♀♀, 13♂♂ (BM(NH) 1979.785–794).

TYPE LOCALITY. *Discovery* Station 7711, haul 32; 52°54·7′–52°56·5′N, 20°12·6′–20°7·7′W; depth 605–700 m; date 22 May 1971, time 2249–0049 hr; gear RMT 1.

OTHER MATERIAL EXAMINED. (i) Approximately 3800♀♀, 1500♂♂ and 2900JJ (DC, Wormley). (ii) 10♀♀, 10♂♂ from *Discovery* Station 7711, haul 13 (SI, Washington, USNM 158132). (iii) 1J *Dana* Station 3624–7, in Poulsen's (1973) material of *Metaconchoecia rotundata* (ZM, Copenhagen, tentative identification). (iv) 2♀♀, 1♂ in Fowler's (1909) material of *C. rotundata* (BM(NH) 1910.72.116).

SUPPLEMENTARY DESCRIPTION. **Male.** *Carapace* (Fig. 20). The carapace is only slightly tapered in lateral view. *Frontal organ* (Fig. 22B). The capitulum is similar in shape to that of *C. fowleri* but the ventral spines are rather smaller and more numerous. **Female** *Carapace* (Fig. 21). The lateral outline is like that of the male but rather less elongate; in ventral view the carapace is almost parallel sided. *Frontal organ* (Fig. 22H). The capitulum is less strongly tapered than in *C. fowleri* and has a more bluntly rounded end.

DIMENSIONS. ♂ Carapace length: 0·97–1·14 mm, mean 1·05 ±0·02 mm (n = 664). ♀: 0·95–1·18 mm, mean 1·07 ± 0·02 mm (n = 919). See Tables 3 & 4 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. The lateral outline of *C. discoveryi* tends to be slightly less tapered than that of *C. fowleri* and the posterior end is rather more clearly upturned. The carapace is also somewhat shorter. *C. discoveryi* is distinguished from all other species of the *skogsbergi* complex, including *C. fowleri*, by the relatively posterior position of the left asymmetric gland and the relative shortness of the male first antenna e seta.

GEOGRAPHICAL DISTRIBUTION. *Atlantic Ocean:* abundant in the E. Atlantic between 40°N, 20°W and 60°N, 20°W, less common between 40°N, 20°W and the equator (Angel & Fasham, 1975; Angel, 1979); common in the W. Atlantic around 32°N, 64°W (Angel, 1979). *Pacific Ocean*: single tentatively identified juvenile in *Dana* material from the SW Pacific.

VERTICAL DISTRIBUTION. The overall range in the N. Atlantic is 600 m–1500 m; it is most abundant between 900 m and 1500 m and particularly between 1000 m and 1250 m. At 53°N 20°W the females are most abundant at 1000–1500 m and the males and juveniles at 600–800 m. A similar separation occurs around 32°N 64°W (Angel, 1979).

Conchoecia obtusa sp. nov.
(Figs 23–25)

?Metaconchoecia rotundata (Müller, 1890).—James, 1975 : 114–118, p. XXI, figs l, m, pl. XXII, figs a–l.

Conchoecia rotundata form 2, Angel & Fasham, 1975 : 737 (distribution).—Angel, 1977*a* : 246 (vertical distribution).—Angel, 1979 : 69–70 (vertical distribution).

ETYMOLOGY. L. *obtusus*, blunt: referring to the fact that the lateral carapace outline is not strongly tapered and the anteroventral part of each valve is rounded or bluntly pointed in ventral view.

DIAGNOSIS. Lateral carapace outline usually only slightly tapered in anterior 1/2–2/3. Ventral outline not strong biconvex, in ♂ B > 41% of length; anteroventral part of each valve not sharply pointed in ventral view. LAG lies < 12% of length behind tip of rostrum. ♂ A1 e seta with 23–28 spines. Posterior end gently, usually symmetrically rounded. Length = 0·91–1·06 mm.

TYPE MATERIAL. Holotype: dissected ♂ (BM(NH) 1979.700). Paratypes: 1 dissected ♀ (BM(NH) 1979.701); 41♀♀, 42♂♂ (BM(NH) 1979.726–735).

TYPE LOCALITY. *Discovery* Station 7856, haul 2; 29°58·1′–29°53·6′N, 23°09′–23°1·8′W; depth 405–505 m; date 31 March 1972; time 0910–1110 hr; gear RMT 1.

OTHER MATERIAL EXAMINED. (i) Approximately 1900♀♀, 1400♂♂ and 1650JJ (DC, Wormley). (ii) 20♀♀, 22♂♂, from *Discovery* Station 7856, haul 8 (SI, Washington USNM 158128). (iii) 1♀ *Dana* Station 3583–1, (ZM, Copenhagen).

SUPPLEMENTARY DESCRIPTION. **Male.** *Second antenna* (Fig. 25D). The left hook appendage is rather more strongly developed than in *C. fowleri* whereas the right hook is less well developed. **Female.** *Frontal organ* (Fig. 25H). The end of the capitulum is more pointed and downturned than in *C. fowleri* and the distal part of the ventral margin is clearly concave.

DIMENSIONS. ♂ Carapace length: 0·91–1·00 mm, mean 0·96 ± 0·02 mm (n = 626). ♀: 0·91–1·06 mm, mean 0·97 ± 0·04 mm (n = 672). See Tables 3 and 4 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. *C. obtusa* is consistently smaller than *C. fowleri* and has a rather less tapered, more rectangular outline. In the male, the ventral outline is relatively broader. It is distinguished from *C. discoveryi* by the more symmetrically rounded posterior end, the relatively broader ventral outline of the male and the clearly more anterior position of the left asymmetric gland.

Judging from the carapace length and outline, *C. rotundata* of James (1975) may be this species.

GEOGRAPHICAL DISTRIBUTION. *Atlantic Ocean*: in the E. Atlantic, abundant at 30°N, 23°W, common at 40°N, 20°W, uncommon at 11°N, 20°W and 18°N, 25°W, rare at the equator, 53°N, 20°W and 60°N, 20°W (Angel & Fasham, 1975; Angel, 1979) and uncommon around 44°N, 13°W (Angel, 1977*a*); in the W. Atlantic, abundant at 33°N, 64°W (Angel, 1979). *Indian Ocean*: possibly occurs in the NE Indian Ocean (as *C. rotundata* of James, 1975). *Pacific Ocean*: single female in *Dana* material from the SW Pacific.

VERTICAL DISTRIBUTION. The overall range in the N. Atlantic is 100 m–800 m; it is most abundant between 400 m and 700 m.

Conchoecia skogsbergi Iles, 1953
(Figs 18K–P, 19J–O, 26–29)

Conchoecia rotundata Müller, 1890.—Müller, 1906*a* : 83–84 (in part, long form only), pl. XVII, figs 25–33 (not figs 23, 24 = *C. teretivalvata* Iles, 1953).—Müller, 1908 : 69, 70 (in part). Müller 1912 : 77 (long form only).—Skogsberg, 1920 : 649–658, Fig. CXXII (designated type description by Iles, 1953).—Hillman, 1967 : 200 (mentioned only).—Hillman, 1968 : 158 (listed).—Hillman, 1969 : Map 9 (distribution).

Conchoecia rotundata Müller, 1890, form 10, Angel & Fasham, 1975 : 737 (distribution).

Not *Conchoecia rotundata* Müller, 1890.

Conchoecia skogsbergi Iles, 1953.—Leung, 1972 : 31–32.—Leung, 1973 : 10–11.—Deevey, 1974 : 364 (in part, ♀ > 1·40 mm, ♂ > 1·35 mm only).—Chavtur & Shornikov, 1974 : 286 (mentioned).—Deevey 1978*b* : 54, 55, Fig. 10.

?Conchoecia skogsbergi Iles, 1953.—Angel, 1968*a* : 1–6, figs 1–10.

Not *Conchoecia skogsbergi* Iles, 1953 (= *C. subinflata* sp. nov.).—Angel 1968*b* (= *C. fowleri* sp. nov.).—Deevey 1968 : 54–55, Figs 20a–d, 21a, d, f–h, 22a (= *C. fowleri*).

?Metaconchoecia skogsbergi (Iles, 1953).—Poulsen, 1973: 73–74, Fig. 35.—Chavtur, 1976 : 105–106.—Chavtur 1977*a* : 30 (listed).—Chavtur. 1977*b* : 145–146.

Conchoecia (Metaconchoecia) skogsbergi Iles, 1953.—Deevey, 1978*b* : 54–55, Fig. 10.

DIAGNOSIS. Lateral carapace outline tapered in anterior 2/3–3/4 and relatively higher than in *C. fowleri*, posterior end approximately symmetrically rounded. Ventral outline rather weakly biconvex, in ♂ >42·5% of length. LAG lies 11%–15% of length behind tip of rostrum. Length >1·30 mm.

TYPE MATERIAL. Holotype: ♂ (NR Stockholm reg. no. 3101). Paratypes: 2♂♂, 4♀♀, 2JJ (NR Stockholm reg. no. 3101). The type material is part of the collection on which Skogsberg (1920 : 657) based the description of *C. rotundata* that was later designated the type description of *C. skogsbergi* by Iles (1953). Neither the holotype nor the paratypes correspond obviously to Skogsberg's (1920 : Figs CXXII, 1 and 2) figured carapaces, which were, however, also from the type locality.

TYPE LOCALITY. Station 64b of the Swedish 'Antarctic' Expedition of 1901–1903: 48°27′S, 42°36′W; depth 2500–0 m, date 23 June 1902.

OTHER MATERIAL EXAMINED. (i) 2♀♀, 1J, S.A.E. Station 70b in Skogsberg's (1920) material of *C. rotundata* (NR, Stockholm, 238). (ii) 36♀♀, 21♂♂ 12JJ in Müller's (1908) *Gauss* material of *C. rotundata* (Table 2 for station details; ZM, Berlin 26467, 26479, BM(NH) 1924.7.19.184–187). (iii) Specimens collected by *Discovery* II: 2♀♀, 2JJ (*Discovery* Station 1773), 1♀ (1775), 3♂♂ (1776), 2♀♀, 4♂♂, 5JJ (1777), 5♀♀, 1♂, 7JJ (1778), 4♀♀, 1♂, 6JJ (1779), 6♀♀, 2♂♂, 5JJ (1781), 6♀♀, 3♂♂, 2JJ (1782), 2♀ (2018), 1♀, 4JJ (2020), 5♀♀, 10♂♂, 18JJ (2026), 3♀♀ (2391), 1♀, 1♂, 1J (2393), 3♀♀, 3JJ (2495), 1♀ (2496), 3♀♀, 3♂♂, 4JJ (2498), 6♀♀, 4♂♂, 1J (2501) (DC, Wormley). (iv) 2♂♂, dissected, *Discovery* Stations 1777, 1781 (BM(NH) 1979.713, 714); 1♀, dissected (BM(NH) 1979.715), 8♀♀, 1♂ (BM(NH) 1979.756–764) from Station 2393; 4♀♀, 1♂ (BM(NH) 1979.825–827) from Station 1779. (v) Specimens collected by RRS *Discovery*: 1♀ (Station 6665, haul 26), 2JJ (haul 28), 15♀♀, 8♂♂, 16JJ (haul 38), 1♂ (Station 8281, haul 35) (DC, Wormley). (vi) 1♀, dissected, from Norwegian Sea, described by Angel (1968*a*) (BM(NH) 1979.712). (vii) 1♀, dissected, collected below Arctic ice from Fletchers Ice Island (T3) at 85°58′N, mentioned by Leung (1972, 1973) (BM(NH) 1979.711).

SUPPLEMENTARY DESCRIPTION: **Male.** *Carapace* (Figs. 26A–L). The *Valdivia, Gauss* and *Discovery* samples include small, intermediate and large size forms (Table 6, Appendix 1). In ventral view, the anteroventral region of each valve is rather pointed. The surface is usually smooth but a few specimens from *Gauss* Station 12.11.01 have fine longitudinal striations near the ventral margin. *Frontal organ* (Figs. 18K–P). The capitulum is generally similar to that of *C. fowleri* but tends to vary in shape. Intermediate form: the proximal half of the capitulum is rather expanded with a strongly convex ventral margin, the distal half is parallel sided or slightly tapered. Small form: the capitulum is more slender, the proximal part of the ventral margin being less strongly convex. Large form (one specimen): the capitulum is only slightly expanded proximally with a blunt terminal spine. *First antenna* (Fig. 28A, C). The d seta has a number of minute spines on the postero-lateral surface behind the main anterior spines. *Second antenna* (Fig. 28D, E). There are considerably more spines on the anterior surface of the g seta than in *C. fowleri* (Table 5); these extend down onto the distal thin-walled part of the seta. *Mandible.* On the proximal tooth list, the third large tooth, near the middle of the list, is sometimes comparable in size to the second large tooth.
Female. *Carapace* (Fig. 27). There are three size forms corresponding to those of the male. The lateral outline is similar to the male but is rather variable; in particular, the relative height varies and the ventral margin ranges from being slightly concave in smaller specimens to slightly convex in larger specimens. *Frontal organ* (Fig. 19J–O, 28H). The capitulum outline is variable. In the small and intermediate forms it is similar in shape to that of *C. fowleri* but the captilulum of the large form tends to be relatively higher, the ventral margin is more or less concave in the distal half and the end is more pointed and downturned.

DIMENSIONS. See Table 6 for carapace dimensions, Tables 7, 8 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. The S. Atlantic *Discovery* material of *C. skogsbergi* is closely similar to the specimens described by Müller (1908) and Skogsberg (1920) from the same general area. It also compares closely with the female specimen of Leung (1972 : 1973) which was caught in the central Arctic Ocean. The female described by Angel (1968*a*) from the Norwegian Sea is rather small for *C. skogsbergi* (Table 6) and differs in a number of morphometric characters from typical Southern Hemisphere material. It is therefore placed only tentatively in this species. *Discovery* specimens from deep water in the tropical N. Atlantic are usually somewhat lower and narrower than typical specimens, but are otherwise similar.

The present, rather sparse, *Discovery* material suggests that the three size forms in the S. Atlantic are only partially separated in depth and are not sufficiently different morphologically to be regarded as distinct species or subspecies. However, it is possible that these populations are becoming genetically isolated and undergoing speciation.

C. skogsbergi is consistently larger than other species of the *skogsbergi* complex with the exception of *C. fowleri* form A from which it differs in being relatively higher in lateral view. It is similar in size to *C. abyssalis* but has a different lateral outline and no side branches on the male first antenna a and c setae and the female first antenna a and d setae.

GEOGRAPHICAL DISTRIBUTION. *Southern Ocean*: common as far as 70°S in all sectors (Müller, 1906*a*; 1908; 1912; Hillman, 1967; 1968; 1969; Deevey, 1978*b*; this paper). *South Atlantic*: occurs in *Gauss* and *Discovery* material from the SE Atlantic; present in the SW Atlantic (Skogsberg, 1920; Deevey, 1974). *North Atlantic*: rare in E. Atlantic at 11°N, 20°W and 18°N, 25°W (Angel & Fasham, 1975; this paper); Norwegian Sea (Angel, 1968*a*; this paper, tentative identification). *Pacific Ocean*: Bering and Okhotsk Seas, Kurile-Kamchatka Trench (Chavtur & Shornikov, 1974; Chavtur, 1976; 1977*a*; 1977*b*); SW Pacific (Poulsen, 1973; tentative identification). *Arctic Ocean*: 1 female from the central Arctic Ocean (Leung, 1972; 1973; this paper).

VERTICAL DISTRIBUTION. In *Discovery* material from the S. Atlantic, the small size form occurs mainly in the 250–500 m and 500–750 m horizons, the intermediate form in the 500–750 m and 750–1000 m horizons and the large form in the 750–1000 m and 1000–1500 m horizons (Fig. 29). In *Discovery* material from the tropical N. Atlantic *C. skogsbergi* was taken between 1250 and 3600 m. Deevey (1978*b*) records it from 500–2000 m in the Pacific sector of the Southern Ocean. Angel (1968*a*) reports *C. skogsbergi* from 600–1000 m in the Norwegian Sea.

Conchoecia wolferi sp. nov.
(Figs 30, 31)

Conchoecia rotundata form 11, Angel & Fasham 1975 : 737 (distribution).

ETYMOLOGY. The name is an anagram of *fowleri* and reflects the close relationship between these two species.

DIAGNOSIS. Lateral carapace outline rather gently tapered in anterior 2/3 to 3/4. Ventral carapace outline not strongly biconvex, in ♂ B usually >42% of length; anteroventral parts of each valve not sharply pointed in ventral view. LAG lies <12·0% of length behind tip of rostrum. ♂ A1 e seta with 24–28 spines. Posterior end symmetrically rounded or somewhat downturned. Length = 1·06–1·26 mm.

TYPE MATERIAL. Holotype: dissected ♂ (BM(NH) 1979.704). Paratypes: 1 dissected ♀ (BM(NH) 1979.705), 21♀♀, 20♂♂ (BM(NH) 1979.805–814).

TYPE LOCALITY. *Discovery* Station 6665, haul 4; 10°32·7′N, 19°57·4′W; depth 400–295 m; date 22 January 1968; time 1559–1731 hr; gear N113 CDB.

OTHER MATERIAL EXAMINED. (i) Approximately 320♀♀, 200♂♂ and 37JJ (DC, Wormley). (ii) 19♀♀, 17♂♂ from *Discovery* Station 6665, haul 8 (SI, Washington, USNM 158127). (iii) 1♀, *Dana* Station 3583–1 in Poulsen's (1973) material of *Metaconchoecia rotundata* (ZM, Copenhagen, tentative identification).

DIMENSIONS. ♂ Carapace length: 1·06–1·20 mm, mean 1·13 ± 0·02 mm (n = 405). ♀: 1·10–1·26 mm, mean 1·17 ± 0·03 mm (n = 521). See Tables 3 and 4 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. This species is similar in shape to *C. fowleri* and *C. discoveryi* but is broader in ventral view with a somewhat downturned, rather than upturned, posterior end, and a more anteriorly situated left asymmetric gland. *C. wolferi* is consistently larger than *C. obtusa,* the lateral outline is relatively more elongate and the posterior end tends to be more downturned.

GEOGRAPHICAL DISTRIBUTION. *Atlantic Ocean*: fairly common around 11°N, 20°W and 18°N, 25°W in E. Atlantic and on the equator. *Pacific Ocean.* single tentatively identified female in *Dana* material from SW Pacific.

VERTICAL DISTRIBUTION. The overall range in the N. Atlantic is 300–800 m. At 11°N, 20°W it is most abundant betweeen 300 m and 400 m, at 18°N, 25°W it is most abundant at depths of 400 m to 600 m.

Conchoecia acuta sp. nov.
(Figs 32–34)

Conchoecia rotundata Müller, 1890.—Müller, 1908 : 69, 70 (in part).
Conchoecia rotundata forms 4, 12 Angel & Fasham 1975 : 737 (distribution).—Angel, 1979 : 71, fig. 59 (vertical distribution).

ETYMOLOGY. L. *acutus,* pointed: referring to the rather strongly tapered lateral outline and the sharply pointed shape of the anteroventral region when viewed ventrally.

DIAGNOSIS. Lateral outline relatively higher than in *C. fowleri* and clearly tapered in anterior 2/3 to 3/4. Posterior end approximately symmetrically rounded. Ventral outline weakly biconvex in ♀ (B = 35–46% of length), more strongly biconvex in ♂ (B = 42·5–50% of length); anteroventral part of each valve pointed in ventral view. LAG lies < 11·5% of length behind tip of rostrum. ♂A1 e seta with 20–24 spines. Length = 0·85–1·00 mm. ♂A2 f seta < 38%, g seta < 42%, ♀ A2 LSS < 41%, f–j seta < 20% of length.

TYPE MATERIAL. Holotype: dissected ♂ (BM(NH) 1979.690). Paratypes: 1 dissected ♀ (BM(NH) 1979.691); 1 dissected ♂ (BM(NH) 1979.692); 20♂♂, 24♀♀ (BM(NH) 1979.736–745).

TYPE LOCALITY. *Discovery* Station 7089, haul 19; 17°48′N, 25°22′W; depth 197–112 m; date 15 November 1969; time 1307–1537 hr; gear RMT 1.

OTHER MATERIAL EXAMINED. (i) Approximately 950♀♀, 550♂♂, 350JJ (DC, Wormley). (ii) 16♀♀, 16♂♂ from *Discovery* Station 7856, haul 22 (SI, Washington USNM 158131). (iii) Specimens in Müller's (1908) material of *C. rotundata*: 81♀♀, 29♂♂, 10JJ (*Gauss* Station 19.10.01d); 26♀♀, 13♂♂ (19.10.01c); 10♀♀, 7♂♂ (26.10.01); 1♀, 2♂♂ (5.11.01a); 3♀♀, 2♂♂ (12.11.01); ?1♀ (18.5.03) (ZM, Berlin, 26465, 26474). (iv) 5♀♀, 3♂♂ in Müller's (1906*a*) material of *C. rotundata* from *Valdivia* Station 26 (ZM, Berlin, 16483, all tentative identifications).

SUPPLEMENTARY DESCRIPTION. **Male.** *Second antenna* (Figs 34D, E). The hook appendages are similar to those of *C. fowleri* but more nearly equal in size. **Female.** *Frontal organ* (Fig. 34H). The capitulum is similar in shape to that of *C. fowleri* but has a rather more pointed and downturned tip.

DIMENSIONS. ♂ Carapace length: 0·85–0·99 mm, mean 0·91 ± 0·04 mm (n = 457). ♀: 0·85–1·01 mm, mean 0·93 ± 0·01 mm (n = 723). See Tables 11 and 12 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. *C. acuta* resembles Müller's (1890, pl. XXVIII, fig. 42) original *C. rotundata* in lateral view but is more elongate and also considerably smaller. Compared with *C. obtusa*, the lateral outline is more tapered and the ventral outline is more convex with the anteroventral part of each valve being pointed rather than rounded and the rostrum more produced. *C. acuta* is consistently smaller than *C. fowleri* and *C. wolferi* and the left asymmetric gland has a clearly more anterior position than in *C. discoveryi*.

GEOGRAPHICAL DISTRIBUTION. *North Atlantic Ocean*: common in the E. Atlantic between the equator and 30°N, 23°W (Angel & Fasham, 1975; this paper), but its reported occurrence at 40°N, 20°W has not been confirmed; common in the W. Atlantic around 32°N, 64°W (Angel, 1979; this paper). *South Atlantic Ocean*: fairly common in *Gauss* material from 19°S to 35°S in the E. Atlantic. *Indian Ocean*: 1♀ from the SE Indian Ocean in *Gauss* material (tentative identification).

VERTICAL DISTRIBUTION. The overall range in the N. Atlantic is 50–500 m; it occurs mainly in the top 300 m, particularly between 100 m and 200 m.

Conchoecia aff. ***acuta***
(Figs 35, 36)

Conchoecia rotundata Müller, 1890.—Müller, 1908 : 69, 70 (in part).
Metaconchoecia rotundata (Müller, 1890).—Poulsen, 1973 : 71–72; Figs 34a–j.

MATERIAL EXAMINED. *Broad form. Dana* Stations 3587–6 (1♂), 3611–2 (1♂, 1J), 3613–3 (25♀♀), 3613–8 (3♀♀, 4♂♂), 3613–9 (3♀♀, 2♂♂), 3613–10 (17♀♀, 14♂♂, 5JJ), 3623–2 (1♀, 1♂), 3623–5 (29♀♀, 10♂♂, 4J), 3624–2 (16♀♀, 7♂♂), 3624–3 (2♀♀, 1♂), 3624–4 (8♀♀, 2♂♂), 3624–5 (27♀♀, 11♂♂), 3624–7 (1♀, 2♂♂, 1J), 3624–8 (60♀♀, 20♂♂, 6JJ), 3625–2 (8♀♀, 6♂♂, 6JJ), 3625–5 (75♀♀, 24♂♂, 19JJ) (ZM, Copenhagen). *Narrow form. Dana* Stations 3613–3 (2♀♀), 3613–10 (3♀♀), 3623–2 (1♂), 3623–5 (6♀♀), 3625–2 (2♀♀, 1♂), 3684–2 (1♀), 3687–10 (2♀♀), (ZM, Copenhagen). *Gauss* Stations 26.10.01 (3♀♀), 5.11.01a (7♀♀) (ZM, Berlin 26474).

REMARKS. Poulsen's (1973) *Dana* material of *Metaconchoecia rotundata* from the SW Pacific mainly comprises a form which is close to *C. acuta* but is relatively broader, with females tending to be widest behind the mid-point (Fig. 35C–Q, 36M–DD). There is also a second form resembling *C. acuta* in the *Dana* samples. This form, which is also present in Müller's (1908) *Gauss* material from the S. Atlantic, is consistently narrower than the broad form, clearly so in females, and on averager is narrower than the typical N. Atlantic form of *C. acuta* (Figs 35A, B, 36A–C). In other respects, both the Pacific forms are closely similar to N. Atlantic specimens.

Because they occur together and differ clearly in carpace width, these broad and narrow forms are probably distinct species. However, their relationship to the Atlantic *C. acuta* is unclear.

DIMENSIONS. See Table 10 for carapace dimensions.

Conchoecia australis sp. nov.
(Figs. 37, 38)

Conchoecia rotundata Müller, 1890.—Müller, 1908 : 69–70 (in part).—Skogsberg 1920 (in part).

ETYMOLOGY. L. *australis*; referring to the southerly distribution of this species.

DIAGNOSIS. Lateral outline clearly tapered in anterior 2/3 to 3/4, posterior end symmetrically rounded. Length = 0·99–1·08 mm. Ventral outline weakly biconvex in ♀ (B usually < 46% of length), more strongly biconvex in ♂ (B = 45–54% of length). Anteroventral part of each valve pointed in ventral view. LAG opens < 13% of length behind tip of rostrum. Carapace height usually > 50% of length, ♂ A2 LSS > 60% and ♀ A2 LSS > 47·5% of length.

TYPE MATERIAL. Holotype: dissected ♂ (BM(NH) 1980.141). Paratypes: 1 dissected, ♀, 3 dissected ♂♂ (BM(NH) 1980.142–145); 4♀♀, 6♂♂ (BM(NH) 1979.775–784).

TYPE LOCALITY. *Discovery* Station 2026; 38°56′S, 00°10·2′E; depth 500–250 m; date 1 April 1937; time 1600 hr; gear N70V.

OTHER MATERIAL EXAMINED. (i) Material collected by *Discovery* II in the S. Atlantic: *Discovery* Station 1774 (2♀♀, 1♂), 1776 (1♀), 1777 (1♀), 2026 (1♀, 5♂♂, 16JJ), 2386 (2♀♀), (DC, Wormley). (ii) 26♀♀, 4♂♂ from *Gauss* Station 18.12.1 in Müller's (1908) material of *C. rotundata* (ZM, Berlin 26468). (iii) 1♀, 1♂ from S.A.E. Stations 65b and 66b in Skogsberg's (1920) material of *C. rotundata* (NR, Stockholm, 236, 237).

SUPPLEMENTARY DESCRIPTION. **Male.** *Second antenna* (Fig. 38D, E). The left hook appendage passes through a rounded angle of 90° rather than being smoothly curved as in *C. fowleri*. There are 9–10 prominent subterminal ridges. **Female.** *Frontal organ* (Fig. 38H). The capitulum has a rather more pointed and downturned end; the distal part of the ventral margin is somewhat concave.

DIMENSIONS. ♂ Carapace length: 0·98–1·06 mm, mean 1·01 ± 0·02 mm (n = 17). ♀: 0·99–1·08 mm, mean 1·00 ± 0·03 mm (n = 35). See Tables 11 and 12 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. On average, *C. australis* has a relatively higher carapace than other species of the *skogsbergi* complex and the longest swimming setae on the second antenna of both sexes are always proportionally longer than in any species except *C. skogsbergi*. The male first antenna b and d seta and the male second antenna f and g setae also tend to be relatively long. *C. australis* is consistently larger than both *C. rotundata* and *C. acuta*.

GEOGRAPHICAL DISTRIBUTION. *South Atlantic*: known from five stations situated between 39°S and 50°S in the SW and SE Atlantic. *Indian Ocean*: one *Gauss* Station in the SW Indian Ocean.

VERTICAL DISTRIBUTION. The overall depth range in *Discovery* material is 250–750 m. It occurs mainly between 500 m and 750 m.

Conchoecia inflata sp. nov.
(Figs 39–42)

Conchoecia rotundata Müller, 1890.—Müller, 1908 : 69.70 (in part).
Conchoecia rotundata forms 8, 14, Angel & Fasham, 1975 : 737 (distribution).—Angel, 1977*a* : 246 (vertical distribution).—Angel, 1977*b*: Fig. 1 (size distribution).—Angel, 1979 : 72, Fig. 62 (vertical distribution).
?Metaconchoecia cf. *rotundata* 8 sensu Angel, Martens, 1978 : 159.—Martens, 1979 : 351 (possible subspecies).

ETYMOLOGY. L. *inflatus*, swollen; referring to the broad swollen carapace.

DIAGNOSIS. Lateral outline clearly tapered in anterior 2/3 to 3/4. Posterior end gently rounded in ♀, weakly rounded to almost straight in ♂. L = 0·96–1·16 mm. ♂ A1 seta with 19–26 spines. LAG lies < 11·5% of length behind tip of rostrum. In ventral view carapace broad, B > 46% (♀) > 50% (♂) of length, biconvex with strongly curved sides in ♂, curved or almost straight sides in ♀.

TYPE MATERIAL. Holotype: dissected ♂ (BM(NH) 1979.698). Paratypes: 1 dissected ♀ (BM(NH) 1979.699); 8♀♀, 10♂♂ (BM(NH) 1979.716–725).

TYPE LOCALITY. *Discovery* Station 6665, haul 24; 10°31·3′N, 19°58′W; depth 1490–1260 m; date 25 February 1968; time 0404–0835 hr; gear N113 CDB.

OTHER MATERIAL EXAMINED. (i) Approximately 1000♀♀, 850♂♂, 1250JJ (DC, Wormley). (ii) 10♀♀, 12♂♂ from *Discovery* Station 7856, haul 15, (SI, Washington, USNM 158129). (iii) 3♀♀,

1J, *Dana* Station 3587–6, in Poulsen's (1973) material of *Metaconchoecia rotundata* (ZM, Copenhagen). (iv) Specimens in Müller's (1908) material of *C. rotundata* (ZM, Berlin 26480): 2♂♂ (*Gauss* Station 19.10.01d), 2♀♀, 4♂ (12.11.01), 5♀♀, 1♂ (4.9.03), 2♀♀ (30.9.03b). (v) 2♀♀, 1♂ *Valdivia* Station 26, in Müller's (1906a) material (ZM, Berlin 26481, tentative identifications).

SUPPLEMENTARY DESCRIPTION. **Male.** *Frontal organ* (Fig. 41B). The capitulum is similar in shape to that of *C. fowleri* but is relatively higher. *Second antenna* (Figs 41D, E). The right hook appendage is only slightly larger than the left hook. *Penis* (Fig. 42). The number of transverse muscles is unusually variable, ranging from two to six. **Female.** *Frontal organ* (Fig. 41H). The capitulum is relatively higher than in *C. fowleri*, the end is pointed and downturned and the ventral margin distally concave.

DIMENSIONS. ♂ Carapace length: 0·99–1·16 mm, mean 1·08 ± 0·02 mm (n = 493). ♀: 0·97–1·16 mm, mean 1·07 ± 0·03 mm (n = 699). See Tables 11 and 12 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. *C. inflata* is comparable in size to Müller's (1890) original *C. rotundata*. The lateral outline is also similar although relatively lower and more elongate. However, as discussed above, the initial description of *C. rotundata* was inadequate and a proper comparison with other species such as *C. inflata* is now impossible. Martens (1979 : 351) records a form similar to *C. inflata*, possibly a subspecies, from the SE Pacific.

The broad ventral outline, which is particularly obvious in the female, distinguishes *C. inflata* from other *skogsbergi* complex species. The very gently curved, almost vertical posterior end is also characteristic.

GEOGRAPHICAL DISTRIBUTION. *North Atlantic Ocean*: in the E. Atlantic, abundant at 30°N, 23°W, fairly uncommon at 11°N, 20°W, 18°N, 25°W and 40°N, 20°W, rare at 53°N, 20°W (Angel & Fasham, 1975; Angel, 1979; this paper) and uncommon at 44°N, 13°W (Angel, 1977*a*); in the W. Atlantic, uncommon at 32°N, 64°W (Angel, 1979; this paper). *South Atlantic Ocean*: occurs in *Gauss* material from 12°S to 35°S in the E. Atlantic. *Pacific Ocean*: a few specimens in *Dana* material from the SW Pacific; a related form, possibly a subspecies, occurs off the Chilean coast (Martens, 1979).

VERTICAL DISTRIBUTION. The overall range in the N. Atlantic is 200–1500 m; it occurs mainly between 200 m and 500 m, but is usually rather deeper (500–600 m) at 32°N, 64°W.

Conchoecia rotundata Müller, 1890
(Figs 43, 44)

Conchoecia rotundata Müller, 1890 : 275, pl. XXVIII, figs 41–43, pl. XXIX, fig. 44.—Müller, 1908 : 69–70 (in part).—Deevey, 1968 : 51–54 (in part: ♀ = 0·77–1·00 mm; ♂ = 0·75–0·97 mm), Figs 20e–j, 21b, c, i, j, k (not 21e, too large: ♂ L = 0·97 mm), 22c–e (not b, too large: ♂ L = 0·97 mm).

Not *Conchoecia rotundata* Müller, 1890.—Hillman, 1967 : 200 (= *C. skogsbergi* Iles, 1953).—Hillman, 1968 : 158 (= *C. skogsbergi*).—Hillman, 1969: Map 9 (= *C. skogsbergi*).—Deevey, 1970 : 810 (too large: ♀ = 0·85–1·15 mm, ♂ = 0·85–1·10 mm).—Poulsen, 1973 : 71–72, text-figs 34a–j (= *C.* aff. *acuta*).—Deevey, 1974 : 364, Fig. 5h (in part) (too large: ♀ = 0·87–0·95 mm, ♂ = 0·80–0·85 mm).—Williams, 1975 : 225, 227, text-fig. 8a (= *C. teretivalvata* Iles, 1953).—Deevey, 1978*a*: 70 (too large: ♂ = 0·90–0·95 mm, 1·10 mm).

Not *Metaconchoecia rotundata* (Müller, 1890).—James, 1975 : 114–118, pl. XXI, figs 1, m, ml, pl. XXII, figs a–l (? = *C. obtusa* sp. nov.).

DIAGNOSIS. Lateral carapace outline clearly tapered in anterior 2/3 to 3/4. Posterior end approximately symmetrically rounded. Ventral outline weakly biconvex in ♀ (B = 35–43% of length), more strongly in ♂ (B = 41–47% of length); anteroventral part of each valve pointed in ventral view. LAG lies < 11% of length behind tip of rostrum. ♂ A1 e seta with only 14–18 spines. Length = 0·70–0·87 mm.

MATERIAL EXAMINED. (i) Approximately 2100♀♀, 3000♂♂, 100JJ (DC, Wormley). (ii) 1♂, 1♀, both dissected, from *Discovery* Station 8271 (BM(NH) 1979.709, 710); 35♀♀, 40♂♂, from *Discovery* Station 8281, haul 31, (BM(NH) 1979.765–774). (iii) 17♀♀, 25♂♂ from *Discovery* Station 8281, haul 2 (SI, Washington, USNM 158124). (iv) Specimens in Müller's (1908) material of *C. rotundata* (ZM, Berlin 13048, 13049): 1♀, 11♂♂ (*Gauss* Station 19.10.01c), 3♂♂ (19.10.01d) 4♀♀ (26.10.01), 1♀ (12.11.01), 1♀, 1♂ (2.5.03, tentative identifications), 1♀ (18.5.03, tentative identification).

SUPPLEMENTARY DESCRIPTION OF FEMALE. *Frontal organ* (Fig. 44H). The shape of the capitulum is rather different from that of *C. fowleri.* The ventral margin is convex proximally, concave distally and the tip is bluntly pointed and downturned. *First antenna* (Figs 44G, I). Many of the more proximal e seta spines, particularly those on the anterior side, lie close to the seta and because of the small size of this species, they are very difficult to see. *Sixth limb.* As described for *C. fowleri* except that the ventral seta on the final segment is slightly longer than the dorsal seta.

DIMENSIONS. ♂ Carapace length: 0·71–0·83 mm, mean 0·78 ± 0·20 mm (n = 454). ♀: 0·73–0·87 mm, mean 0·80 ± 0·02 mm (n = 446). See Tables 11 and 12 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. The *Discovery* material is closely similar to *C. rotundata* of Deevey (1968). However, there are two differences: (i) Deevey's (1968) specimens have a considerably greater size range (see synonomy for size data) and (ii) the larger specimens have more male first antenna e seta spines (20–22) than any of the males described here. These partial discrepancies suggest that Deevey (1968) included another, larger species of the *skogsbergi* complex with *C. rotundata.* The specimens that Deevey (1970; 1974; 1978*a*) later placed in *C. rotundata* are all, at least in part, too large (see synonomy) to belong in this species.

Müller's (1908) *Gauss* material of *C. rotundata* includes a few specimens from the Indian and Atlantic Oceans which are closely similar to the *Discovery* specimens. Reexamination of Poulsen's (1973) material shows that his *C. rotundata* belongs to a form close to *C. acuta. C. rotundata* of James (1975) may be *C. obtusa.* Hillman's (1967; 1968; 1969) Antarctic *C. rotundata* is presumably *C. skogsbergi* while the *C. rotundata* caught during Continuous Plankton Recorder surveys of the N. Atlantic (Williams, 1975) is now known to be *C. teretivalvata* (Williams, pers. comm. 1976).

C. rotundata is consistently shorter than any other species of the *skogsbergi* complex and also has fewer male first antenna e seta spines. The lateral outline is relatively higher and more tapered than in *C. fowleri, C. discoveryi, C. obtusa, C. skogsbergi* and *C. wolferi,* and in ventral view, the male carapace is more strongly biconvex, with the anteroventral part of each valve being clearly pointed rather than bluntly pointed or rounded. *C. rotundata* is readily distinguished from *C. kyrtophora, C. nasotuberculata* and *C. teretivalvata* by its more elongate lateral outline.

GEOGRAPHICAL DISTRIBUTION. *Altantic Ocean*: abundant at 30°N, 23°W and 32°N, 64°W and rare at 40°N, 20°W (Angel & Fasham, 1975; Angel, 1977*a*; 1979; Deevey, 1968; this paper); records from 15°N–35°S in W. Atlantic and off coast of Venezuela (Deevey, 1970; 1974; 1978*a*) are doubtful (see above); a few specimens in *Gauss* material from 19°S to 35°S in E. Atlantic. *Indian Ocean*: three specimens from two *Gauss* stations in E. and S. Central Indian Ocean (Table 2).

VERTICAL DISTRIBUTION. The overall range in the N. Atlantic is 100–600 m; it is most common between 200 m and 400 m.

Conchoecia subinflata sp. nov.
(Figs 45–47)

Conchoecia rotundata Müller, 1890.—Müller, 1908 : 69, 70 (in part).—Fowler, 1909 : 249–251, Fig. 205 (Stage II in part; not Stage I = *C. teretivalvata* Iles, 1953).

?Conchoecia rotundata Müller, 1890.—Müller, 1906*a* : 183, 184 (in part).
Not *Conchoecia rotundata* Müller, 1890.
Conchoecia skogsbergi Iles, 1953 : 264, 265.
Conchoecia rotundata form 3, Angel & Fasham, 1975 : 737 (distribution).—Angel, 1977*a* : 246 (vertical distribution).—Angel, 1979 : 70, fig. 58 (vertical distribution).

ETYMOLOGY. L. *sub,* somewhat; *inflatus*, swollen: referring to the fact that the carapace is similar in shape to that of *C. inflata* but is less inflated.

DIAGNOSIS. Lateral outline clearly tapered in anterior 1/2 and 3/4. Posterior end symmetrically rounded. Ventral carapace outline only weakly biconvex, sometimes almost parallel-sided in ♀ (B = 35%–39% of length), fairly strongly biconvex in ♂; anteroventral part of each valve clearly pointed in ventral view. LAG lies <11% of length behind tip of rostrum. ♂ A1 e seta with 18–22 spines. Length = 0·95–1·20 mm. ♂ A2 f seta >40%, g seta >43%, ♀ A2 LSS >41%, f–j setae >20% of length.

TYPE MATERIAL. Holotype: dissected ♂ (BM(NH) 1979.702). Paratypes: 1 dissected ♀ (BM(NH) 1979.703); 44♀♀, 47♂♂, (BM(NH) 1979.815–824).

TYPE LOCALITY. *Discovery* Station 7709, haul 27; 60°8·7′–60°11·0′N, 19°59·9′–19°51·5′W; depth 500–600 m; date 28 April 1971; time 1751–1951 hr; gear RMT 1.

OTHER MATERIAL EXAMINED. (i) Approximately 3800♀♀, 2400♂♂, 4600JJ (DC, Wormley). (ii) 44♀♀, 47♂♂, *Discovery* Station 7709, haul 23 (SI, Washington, USNM 158130). (iii) 6♀♀, 2♂♂, 5JJ, *William Scoresby* Station 977, in Iles (1953) material of *C. skogsbergi* (DC, Wormley). (iv) 2♂♂ in Fowler's (1909) material of *C. rotundata*, redetermined by Iles as *C. skogsbergi* (BM(NH) 1910.72.117). (v) Specimens in Müller's (1908) material of *C. rotundata* (ZM, Berlin, 26478, 26466): 1♂ (*Gauss* Station 19.10.01c), 16♀♀, 3♂♂ (19.10.01d), 1♀ (5.11.01a), 3♀♀, 3♂♂ (12.11.01), 1♀ (2.5.03, tentative identification). (vi) 16♀♀, 6♂♂, *Valdivia* Station 121d in Müller's (1906*a*) material of *C. rotundata* (ZM, Berlin 26482; tentative identifications). (vii) 1♀, *Dana* Station 3587–6, in Poulsen's (1973) material of *M. rotundata* (ZM, Copenhagen). (viii) 1♂, *Valdivia* Station 182, in Müller's (1906a) material (ZIZM Hamburg K–18937, tentative identification).

SUPPLEMENTARY DESCRIPTION. **Male.** *Carapace* (Fig. 45). In ventral view the carapace may be slightly constricted behind the second antenna insertion. **Female.** *Carapace.* In an occasional variant (Figs. 46U, CC, DD) the posterior half of the carapace is variably inflated, the inflation being visible only with the animal on its back. *Frontal organ* (Fig. 47H). The end of the capitulum is pointed and downturned and the distal part of the ventral surface is concave.

DIMENSIONS. ♂ Carapace length: 0·95–1·20 mm, mean 1·04 ± 0·02 mm (n = 880). ♀: 0·95–1·18 mm, mean 1·05 ± 0·03 mm (n = 1508). See Tables 11 and 12 for other morphometric data and Table 9 for left asymmetric gland positions.

REMARKS. This species has been identified in some of Fowler's (1909) *C. rotundata* material from the Bay of Biscay and Fowler's (1909: fig. 205) figured 'Stage I' male has a closely similar lateral outline. On the other hand, the female carapace outline (Fowler, 1909: fig. 215) is quite different and cannot be assigned to any known *skogsbergi* complex species. The specimens from the Benguela Current which Iles (1953) placed in *C. skogsbergi* have been reexamined and identified as *C. subinflata.* A single, rather damaged male in Poulsen's (1973) material of *Metaconchoecia rotundata* may belong to *C. subinflata* although the left asymmetric gland is much less prominent and situated further back than in typical specimens.

C. subinflata is usually longer than *C. acuta* but the size ranges overlap and specimens of similar size are difficult to separate. *C. subinflata* has a rather less strongly curved posterior margin but can only be reliably distinguished from *C. acuta* by differences in the relative lengths of various seta on the second antenna. Compared with *C. obtusa*, this species usually

has a more clearly tapered lateral outline, the posterior end of the male is less strongly curved and the anteroventral region of each valve is pointed in ventral view rather than being bluntly pointed or rounded. In addition, *C. subinflata* always has more male first antenna e seta spines than *C. obtusa* and there are various meristic differences. *C. subinflata* has a relatively lower lateral outline than *C. australis* and differs in a number of meristic characters. It is similar in lateral outline to *C. inflata* but narrower in ventral view, particularly in the female. *C. subinflata* is consistently larger than *C. rotundata* and the lateral outline is less elongate. The left asymmetric gland is situated more anteriorly than in *C. fowleri* and *C. discoveryi*. The lateral outline is less elongate and more tapered than that of *C. wolferi*.

GEOGRAPHICAL DISTRIBUTION. *North Atlantic Ocean*: In the E. Atlantic abundant at 60°N, 20°W and 53°N, 20°W, fairly common at 40°N, 20°W, 11°N, 20°W and on the equator, uncommon at 18°N, 25°W and 30°N, 13°W (Angel & Fasham, 1975; Angel, 1979; this paper) and common at 44°N, 13°W (Angel, 1977*a*); rare at 32°N, 64°W in the W. Atlantic (Angel 1979; this paper). *South Atlantic*: occurs between 19°S and 35°S in the SE Atlantic in *Valdivia* and *Gauss* material (Tables 1 & 2); off coast of Namibia in *William Scoresby* material. *Indian Ocean*: 1♂ from NE Indian Ocean in *Valdivia* material (Table 1; tentative identification); 1♀ from S. Indian Ocean in *Gauss* material (Table 2; tentative identification). *Pacific Ocean*: 1♀ in *Dana* material from SW Pacific (tentative identification).

VERTICAL DISTRIBUTION. The overall range in the N. Atlantic is 200–900 m. It is most abundant between 200 m and 400 m.

Species relationships within the *rotundata* group

The 19 or 20 species of the *rotundata* group now described fall into three more or less coherent assemblages.

(i) *C. kyrtophora* and *C. nasotuberculata*: the carapace is short and tapered, relatively high and rounded in lateral view with the left asymmetric gland near the tip of the rostrum or just behind the rostrum; viewed ventrally, the carapace is constricted behind the second antenna insertion. These two species are closely related and have frequently been confused but are now known to be quite distinct (Angel, in press). A third species, *C. teretivalvata,* has a similar lateral outline but it lacks the constriction and the shape of the frontal organ capitulum suggests that it may be more closely related to the *skogsbergi* complex.

(ii) *C. arcuata, C. bathyrotundata* Chavtur, 1977 (a possible synonym of *C. arcuata*), *C. isochiera, C. macromma, C. pusilla* and *C. glandulosa*: the ventral margin is arcuate (strongly in *C. isochiera* and *C. arcuata*); except in *C. arcuata*, the right asymmetric gland is displaced some distance down the posterior margin and opens at the end of a triangular process, the left asymmetric gland usually opens in a relatively posterior position, some distance behind the rostrum (particularly in *C. glandulosa, C. macromma* and, to a lesser extent, *C. arcuata*). Within this assemblage, *C. arcuata* and *C. isochiera* are probably closely related while *C. glandulosa*, a large species with a distinctive outline, is probably rather distantly related to the remaining species.

(iii) The ten species of the *skogsbergi* complex: viewed laterally, the carapace is variably tapered, more elongate than in assemblage (i) species and differing from assemblage (ii) species in having an almost straight or slightly curved ventral margin; the right asymmetric gland always opens near the posterior dorsal corner; the left asymmetric gland position is rather variable but it generally opens near the tip of the rostrum. The rare deep water species *C. abyssalis*, the only described member of the *rotundata* group not represented in the *Discovery* collections, may also belong to the *skogsbergi* complex and *C. teretivalvata* should possibly be placed here rather than in assemblage (i). Within the complex there are two groupings. The first comprises *C. fowleri, C. discoveryi, C. obtusa, C. skogsbergi* and *C.*

wolferi in which the carapace is more elongate in lateral view, less strongly biconvex in ventral view with the anteroventral part of each valve being bluntly pointed. The second group comprises *C. acuta, C. australis, C. inflata, C. rotundata* and *C. subinflata* all of which have relatively shorter, more clearly tapered lateral outlines, more strongly biconvex ventral outlines with the anteroventral part of each valve clearly pointed.

Acknowledgements

I am grateful to Mr P. M. David and Dr M. V. Angel for critically reading drafts of this paper. Special thanks go to Dr Angel who introduced me to the project, did much of the initial identification work and patiently awaited its much postponed completion. I am also grateful to Dr E. J. Iles for his help during the earlier stages of this study, Dr A. L. Rice for his forebearance while ostracods diverted me from other duties and to Mrs P. Talbot who patiently typed the long and difficult manuscript.

Finally, I acknowledge with thanks the following people who have kindly made available museum material: Drs G. A. Boxshall, BM(NH); I. Groth, E.-M.-Arndt-Universität, Greifswald; H.-E. Gruner, ZM, Berlin; J. Martens, ZIZM, Hamburg; R. Oleröd, NR. Stockholm; T. Wolff, ZM, Copenhagen.

This study was supported by a NERC Research Fellowship.

References

Angel, M. V. 1968*a*. *Conchoecia skogsbergi* (Iles), a halocyprid ostracod new to the Norwegian Sea. *Sarsia* **33** : 1–6.

—— 1968*b*. The thermocline as an ecological boundary. *Sarsia* **34** : 299–312.

—— 1969. Planktonic ostracods from the Canary Island region; their depth distributions, diurnal migrations and community organisation. *J. mar. biol. Ass. U.K.* **49** : 515–553.

—— 1972. Planktonic oceanic ostracods—historical, present and future. *Proc. R. Soc. Edinb.* (B) **73** (22) : 213–228.

—— 1973. *Conchoecia* from the North Atlantic the 'procera' group. *Bull. Br. Mus. nat. Hist.* (Zool.) **21** (7) : 259–283.

—— 1977*a*. Studies on Atlantic halocyprid ostracods: vertical distributions of the species in the top 1000 m in the vicinity of 44°N, 13°W. *J. mar. biol. Ass. U.K.* **57** (1) : 239–252.

—— 1977*b*. Some speculation on the significance of carapace length in planktonic halocyprid ostracods. *In* Löffler, H. and Danielpol, D. (eds). *Aspects of ecology and zoogeography of Recent and fossil Ostracoda*. Junk, The Hague: 45–54.

—— 1979. Studies on Atlantic halocyprid ostracods: their vertical distributions and community structure in the central gyre region along latitude 30°N from off Africa to Bermuda. *Prog. Oceanogr.* **8** : 3–124.

—— In press. *Conchoecia nasotuberculata* Müller and *C. kyrtophora* Müller two planktonic halocyprid ostracods that have frequently been confused.

Angel, M. V. & Fasham, M. J. R. 1975. Analysis of the vertical and geographical distribution of the abundant species of planktonic ostracods in the north-east Atlantic. *J. mar. biol. Ass. U.K.* **55** : 709–737.

Athersuch, J. 1976. The G. W. Müller ostracod collection. *Pubbl. staz. Zool. Napoli* **40** : 344–348.

Badcock, J. & Merrett, N. R. 1976. Midwater fishes in the eastern North Atlantic—1. Vertical distribution and associated biology in 30°N, 23°W, with developmental notes on certain myctophids. *Prog. Oceanogr.* **7** : 3–58.

Baker, A. de C., Clarke, M. R. & Harris, M. 1973. The N.I.O. combination net RMT (1 + 8) and further developments of rectangular midwater trawls. *J. mar. biol. Ass. U.K.* **53** (1) : 167–184.

Chavtur, V. G. 1976. The fauna of pelagic ostracods of the far eastern seas. *Sb. Rab. Inst. Biol. morya, Vladivostok* **6** : 99–109.

—— 1977*a*. Fauna of the pelagic ostracods of Halocypridae family from the northwestern Pacific. *Biologiya morya* **1** : 28–38.

—— 1977*b*. The composition and vertical distribution of pelagic ostracods in the Kurilo-Kamchatka trench region. *Trudy Inst. Okeanol.* **108** : 136–164.

Chavtur, V. G. & Shornikov, E. I. 1974. Planktonic ostracoda of the Bering Sea. *Zool. Zh.* **53** : 285–288.

Deevey, G. B. 1968. Pelagic ostracods of the Sargasso Sea off Bermuda. *Bull. Peabody Mus. nat. Hist.* **26** : 1–125.

—— 1970. Pelagic ostracods (Myodocopa, Halocyprididae) from the North Atlantic off Barbados. *Proc. biol. Soc. Wash.* **82** (62) : 799–824.

—— 1974. Pelagic ostracods collected on Hudson 70 between the equator and 55°S in the Atlantic. *Proc. biol. Soc. Wash.* **87** (2) : 351–380.

—— 1978*a*. The planktonic ostracods of the Cariaco Trench and adjacent waters. *Proc. biol. Soc. Wash.* **91** (1) : 52–73.

—— 1978*b*. A taxonomic and distributional study of the planktonic ostracods collected on three cruises of the *Eltanin* in the South Pacific and the Atlantic regions of the South Pacific. *In* Pawson, D. L. & Kornicker, L. S. (eds). Biology of the Antarctic Seas. VIII. *Antarct. Res. Ser.* **28** : 43–70.

Fowler, G. H. 1909. Biscayan Plankton. XII. The Ostracoda. *Trans. Linn. Soc. Lond.* (Zool.), Ser. 2, **10** : 219–358, pls 16–27.

Foxton, P. 1963. An automatic opening-closing device for large midwater plankton nets and midwater trawls. *J. mar. biol. Ass. U.K.* **49** : 603–620.

George, J. 1969. A preliminary report on the distribution and abundance of planktonic ostracods in the Indian Ocean. *Bull. natn. Inst. Sci. India* **38** : 641–648.

George, J., Purushan, K. S. & Madhupratap, M. 1975. Distribution of planktonic ostracods along the south-west coast of India. *Indian J. mar. Sci.* **4** (2) : 201–202.

Gooday, A. J. 1976. The taxonomy of *Conchoecia* (Ostracoda, Halocyprididae) of the *gaussi* and *edentata* groups from the north east Atlantic with a note on their ecology. *Bull. Br. Mus. nat. Hist.* (Zool.), **30** (3) : 57–100.

Granata, L. & Caporiacco, L. di 1949. Ostracodes marins recuillis pendant les croisieres du Prince Albert Ier de Monaco. *Result. Camp. scient. Prince Albert I*, **109** : 1–51, pls 1–4.

Hillman, N. S. 1967. Ecology of Antarctic pelagic Ostracoda. *Antarct. J. U.S.* **2** (5) : 199–200.

—— 1968. Studies of Antarctic pelagic Ostracoda. *Antarct. J. U.S.* **3** (5) : 157–158.

—— 1969. Halocyprididae. *In* Hedgpeth, J. W. (ed.). Distribution of selected groups of marine invertebrates in waters south of 35°S latitude. *Antarct. Map Folio Ser.* **11** : 29–30, pls 15–16.

Iles, E. J. 1953. A preliminary report on the Ostracoda of the Benguela Current. *Discovery Rep.* **57** : 259–280.

James, C. M. 1975. Studies on the ostracoda of the Indian seas. Unpublished dissertation. University of Kerala, India. 281 pp.

Leung, Y. M. 1972. Ostracods of the central Arctic. *In* Kobayashi, H. (ed.) *Taxonomic Guides to Arctic Zooplankton (VI).* University of Southern California Department of Biological Sciences Technical Report No 2: 29–40.

—— 1973. On the ostracod fauna of the Arctic Basin. *In* Fernandes, H. R. (ed.) *Final Report on Drift Station Biology: Zooplankton Taxonomy and Sorting Programs.* University of Southern California Department of Biological Sciences: 10–11.

Martens, J. M. 1978. Die pelagischen Ostracoden der Expedition Marchile I (Südost-Pazifik) als Indikatoren für Wasserkörper: Systematik, Verbretung und Zoogeographie. Unpublished dissertation. University of Hamburg, 198 pp.

—— 1979. Die pelagischen Ostracoden der Expedition Marchile I (Südost-Pazifik), II. Systematik und Vorkommen (Crustacea: Ostracoda: Myodocopida). *Mitt. hamb. zool. Mus. Inst.* **76** : 303–366.

Müller, G. W. 1890. Ueber Halocypriden. *Zool. Jb.* **5** (2) : 253–280, pls. XXVIII–XIX.

—— 1894. Die Ostracoden des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. *Fauna Flora Golf. Neapel* Monographie **21** : 1–104.

—— 1906*a*. Ostracoda. *Wiss. Ergebn. dt. Tiefsee-Exped. 'Valdivia'*, **8** : 29–154, pls 5–35.

—— 1906*b*. Die Ostracoden der Siboga-Expedition. *Siboga-Exped.* **30** : 1–40, pls I–IX.

—— 1908. Die Ostracoden der Deutschen Südpolar Expedition 1901–1903. *Südpolar Exped.* **10** : 51–182, pls 4–19.

—— 1912. Ostracoda. *Das Tierreich*, **31** : 1–434.

Poulsen, E. M. 1973. Ostracoda-Myodocopa, 3b. Halocypriformes—Halocypridae, Conchoecinae. *Dana Rep.* **84** : 1–223.

Rudyakov, Yu.A. 1962. Ostracoda Myodocopida (family Halocypridae) from the N.W. Pacific Ocean. *Trudy Inst. Okeanol.* **12** : 97–112.

Skogsberg, T. 1920. Studies on marine ostracodes, 1. Cypridinids, halocyprids and polycopids. *Zool. Bidr. Upps.* Suppl. Bd. **1** : 1–784.

Williams, R. 1975. Continuous plankton records: a plankton atlas of the North Atlantic and North Sea: supplement 4—the Ostracoda in 1963. *Bull. mar. Ecol.* **8** : 215–228.

Manuscript accepted for publication 26 September 1980

Appendix 1

Just before this paper was submitted, I received from the E.M.-Arndt-Universität, Griefswald a collection of 520 *Valdivia* specimens (reg. no. II 25095), determined by G. W. Müller as *C. rotundata*. These specimens have been re-identified and the new identifications are listed below. The station positions are from Müller (1906*a*).

Station	Position	Species present
		Eastern Atlantic Ocean
32 nr. 43	24°43′N, 17°1′W	*C. brachyaskos* 1♀; *C. inflata* 5♀♀; *C. subinflata* 3♀♀; *C. teretivalvata* 35♀♀, 7♂♂, 5JJ; *C. rotundata* group species indeterminate, 65 specimens; *Conchoecia* species indeterminate, 7 specimens.
41	8°58′N, 16°27′W	*C. inflata*, 7♀♀, 1♂, 1J; *C. macrochiera* 1J; *C. nasotuberculata* 2♀♀; *C. procera* 2♀♀; *C. spinirostris* 4♀♀; *C.* cf. *subinflata* 6♀♀, 3♂♂, 4JJ; *C. rotundata* group species indeterminate, 28 specimens.
49	0°20′N, 6°45′W	*C. acuta* 3♀♀; *C. discoveryi* 1♂; *C. elegans* 1♀; *C. fowleri* 12♀♀, 1♂, 1J; *C. inflata* 14♀♀, 3♂♂, 2JJ; *C. procera* 2♀♀; *C. spinirotris* 2♀♀; *C. subinflata* 13♀♀, 3♂♂, 1J; *C. teretivalvata* 4♀♀, 3♂♂; *C. rotundata* group species indeterminate 7♀♀, 3♂♂, 4JJ; *Conchoecia* species indeterminate 7♀♀.
66	3°55′S, 7°48′E	*C.* cf. *inflata* 4♀♀, 1♂; *C. aff. teretivalvata* 1♀.
		Southern Ocean
132	55°20′S, 5°15′E	*C. skogsbergi* 2♀♀ (length = 1·645 mm) 2♂♂ (length = 1·748, 1·773 mm).
135	56°30′S, 14°29′E	*C. skogsbergi* 12♀♀, 5♂♂, 1J. There are three size forms. ♀♀: 1·388, 1·439–1·491, 1·645–1·722 mm. ♂♂: 1·413, 1·491–1·542, 1·645–1·670 mm.
136	55°58′S, 16°14′E	*C. skogsbergi* 1♀ (length = 1·456 mm) 2♂♂ (length = 1·413 mm).
139	55°1′S, 21°34′E	*C. skogsbergi* 7♀♀, 10♂♂. There are two size forms. ♀♀: 1·413, 1·619–1·696 mm. ♂♂: 1·413–1·439 mm, 1·619–1·748 mm.
142	55°27′S, 28°58′E	*C. skogsbergi* 4♀♀, 6♂♂, 1J. There are two size forms. ♀♀: 1·362–1·439, 1·568 mm. ♂♂: 1·413–1·439, 1·568 mm.
		Indian Ocean
217	4°56′N, 78°15′E	*C. hyalophyllum* 1J; *C. lophura* 2JJ; *C.* aff. *subinflata* 27♀♀, 23♂♂, 4JJ; *C. teretivalvata* 27♀♀, 2♂♂, 1J; *C. rotundata* group species indeterminate 2♀♀.
230	2°43′S, 61°12′E	*C. inflata* smaller form 48♀♀ (length = 0·951–1·079 mm), 36♂♂ (length = 0·951–1·002 mm), 3JJ; *C. inflata* larger form 4♀♀ (length = 1·113–1·208 mm), 5♂♂ (length = 1·081–1·156 mm); *C. macromma* 1♀, 2♂♂; *C. procera* 1♀; *C. rotundata* group species indeterminate 2♀♀, 7JJ.
268	9°6′N, 53°41′E	*C.* cf. *subinflata* 1♀; *C. rotundata* group species indeterminate 3♀♀, 1♂, 4JJ.

Table 1 Species identified in material collected by the *Valdivia* during the Deutsche Tiefsee-Expedition and determined by G. W. Müller as *C. rotundata*.

Station	Position	Species present
		North Atlantic Ocean
26	31°59′N, 15°5′W	*C.* cf. *acuta* 5♀ 3♂, *C.* cf. *inflata* 2♀, 1♂.
		South Atlantic Ocean
88	31°0′S, 8°0′E	*C. kyrtophora* 1♀; *C. teretivalvata* 36♀, 6♂, 5J; *rotundata* group indeterminate 2♀.
90	33°20′S, 15°58′E	*C. teretivalvata* 8♀, 4♂, 6J; *rotundata* group indeterminate 1♀.
118	40°31′S, 15°6′E	*C. teretivalvata* 1♀.
121d	43°51′S, 13°6′E	*C.* aff. *subinflata* 16♀, 6♂.
		Indian Ocean
174	27°58′S, 91°40′E	16 indeterminate specimens
182	10°8′S, 97°14′E	*C.* cf. *subinflata* 1♂, *C.* cf. *fowleri* 1♀; indeterminate 1J.

Specimens from Stations 118 and 182 are in the ZIZM, Hamburg (reg. nos K–18937, 18989), other specimens are in the ZM, Berlin (reg. nos 13335, 26481–26485). Station positions are from Müller (1906*a*).

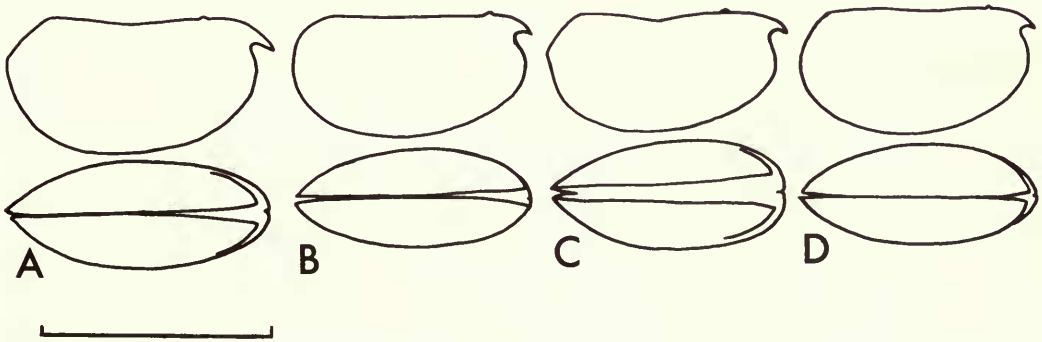

Fig. 1 Lateral and ventral carapace outlines: A, *Conchoecia macromma* ♀, Station 7089 haul 9; B, *C. arcuata* ♀, 7711 haul 47; C, *C. macromma* ♂, 7089 haul 9; D, *C. arcuata* ♂, 7709 haul 12. Scale 1·0 mm.

Table 2 Species identified in material collected by the *Gauss* during the Deutsche Südpolar-Expedition and determined by G. W. Müller as *C. rotundata*.

Station	Position	Species present
		North Atlantic Ocean
30.9.03b	6°N, 22°W	*C. fowleri* 1♀, 1♂; *C. inflata* 2♀.
1.10.03	6°N, 22°W	*rotundata* group indeterminate 1♂.
		South Atlantic Ocean
19.10.01c	19°3′S, 20°W	*C. acuta* 26♀, 13♂, 3J; *C. rotundata* 1♀, 11♂; *C. subinflata* 1♂; *C. procera* 1♀.
19.10.01d	19°3′S, 20°W	*C. acuta* 81♀, 29♂, 10J; *C. fowleri* 1♀ 2♂; *C. inflata* 2♂; *C. rotundata* 3♂; *C. subinflata* 16♀, 3♂.
26.10.01	27°3′S, 16°59′W	*C. acuta* 10♀, 7♂, 1J; *C.* aff. *acuta* 3♀; *C. rotundata* 4♂; *C. teretivalvata* 1♀.
5.11.01a	32°5′S, 8°30′W	*C. acuta* 1♀, 2♂; *C.* aff. *acuta* 7♀; *C. subinflata* 1♀; *C. teretivalvata* 4♀; *C. spinirostris* 1♂.
12.11.01	35°11′S, 2°43′E	*C. acuta* 3♀, 2♂; *C. arcuata* 1♀; *C. fowleri* 1♂, *C. inflata* 2♀, 4♂; *C. rotundata* 1♀; *C. subinflata* 3♀, 3♂; *C. skogsbergi* 5♀, 3J; *C. teretivalvata* 124♀, 34♂, 8J; *C. nasotuberculata* 2♀.
10.8.03	30°S, 11°E	*C. teretivalvata* 1♀.
13.8.03	29°8′S, 8°49′E	*C. teretivalvata* 4♀, 6♂, 1J.
19.8.03	27°30′S, 3°7′E	*C. teretivalvata* 22♀, 16♂, 10J.
4.9.03	12°11′S, 6°14′W	*C. fowleri* 2♀; *C. inflata* 5♀, 1♂; *C. pseudoparthenoda* 1♀.
		Indian Ocean
18.12.01	43°41′S, 36°22′E	*C. skogsbergi* 9♀, 3♂, 2J; *C. australis* 26♀, 4♂.
2.5.03	32°33′S, 73°79′E	*C.* cf. *rotundata* 1♀, 1♂; *C.* cf. *rotundata* 1♀.
18.5.03	26°54′S, 50°17′E	*C.* cf. *acuta* 1♀; *C.* cf. *rotundata* 1♀; indeterminate 1J.
		Southern Ocean
13.2.02	61°58′S, 95°8′E	*C. arcuata* 1♀; *C. skogsbergi* 3♀, 2♂, 1J.
6.3.03	65°S, 85°E	*C. skogsbergi* 1♀, 2♂.
10.3.03	64°29′S, 85°36′E	*C. skogsbergi* 10♀, 5♂, 4J; indeterminate 1♂.
27.3.03	65°S, 80°E	*C. arcuata* 2♀, 1♂; *C. skogsbergi* 7♀, 7♂, 1J.
3.4.03	65°S, 80°E	*C. arcuata* 1♀; *C. skogsbergi* 1♀, 2♂, 1J.

Specimens from Station 3.4.03 are in the BM(NH) (reg. no. 1924.7.19.184–188), other specimens are in the ZM, Berlin (reg. nos 13048–13050, 26465–26485). Station positions are from Müller (1908). The name *C. rotundata* is used in the sense of Deevey (1968).

Table 3 Male morphometric characters.

	C. fowleri *sp. n.*	*C. fowleri* *form A*	*C. discoveryi* *sp. n.*	*C. wolferi* *sp. n.*	*C. obtusa* *sp. n.*
N	42	9	20	22	21
H	44·8 ± 1·0	44·1 ± 1·3	45·1 ± 0·9	43·9 ± 1·0	45·6 ± 1·0
B	41·0 ± 1·3	45·5 ± 2·2	39·4 ± 0·9	44·4 ± 1·6	44·3 ± 1·7
F.O.: shaft	28·9 ± 0·6	28·1 ± 0·6	27·1 ± 0·6	29·3 ± 0·7	28·7 ± 0·7
capitulum	11·8 ± 0·3	10·7 ± 0·5	11·0 ± 0·4	12·1 ± 0·8	12·4 ± 0·5
total	40·6 ± 0·6	38·7 ± 0·7	38·2 ± 0·7	41·5 ± 1·0	41·1 ± 0·9
A1: seg. 1	15·0 ± 0·4	14·9 ± 0·6	15·6 ± 0·4	15·5 ± 0·6	15·3 ± 0·3
seg. 2	18·0 ± 0·3	17·7 ± 0·3	15·7 ± 0·3	18·4 ± 0·4	18·3 ± 0·4
total	33·1 ± 0·5	32·6 ± 0·8	31·4 ± 0·6	33·9 ± 0·7	33·6 ± 0·4
a seta	31·0 ± 1·9	31·9 ± 2·8	27·2 ± 2·0	31·0 ± 2·5	34·1 ± 2·3
b seta	43·7 ± 0·7	45·0 ± 0·8	39·5 ± 0·8	45·0 ± 1·2	44·2 ± 0·9
c seta	4·2 ± 0·5	4·7 ± 0·5	4·1 ± 0·6	4·2 ± 0·4	4·5 ± 0·6
d seta	45·8 ± 1·0	47·3 ± 0·7	40·9 ± 0·9	46·5 ± 0·9	46·2 ± 1·0
e seta	53·0 ± 0·7	55·6 ± 0·8	42·1 ± 0·7	57·6 ± 1·3	55·9 ± 0·9
A2: protop.	47·7 ± 0·8	46·7 ± 0·8	46·9 ± 0·7	49·7 ± 0·9	49·1 ± 1·2
Ex. 1	21·2 ± 0·4	21·9 ± 0·2	21·9 ± 0·6	21·8 ± 0·3	22·1 ± 0·5
Ex. 2–8	8·2 ± 0·2	7·8 ± 0·3	8·5 ± 0·3	8·7 ± 0·2	8·5 ± 0·6
LSS	53·7 ± 1·1	54·7 ± 2·0	53·8 ± 1·1	52·5 ± 1·1	52·2 ± 1·8
f seta	39·4 ± 1·0	39·1 ± 0·8	34·9 ± 1·0	37·0 ± 1·0	38·9 ± 1·2
g seta	41·7 ± 0·6	40·7 ± 1·0	37·7 ± 0·6	39·9 ± 1·4	43·0 ± 1·5
h–j setae	15·8 ± 1·3	14·7 ± 1·6	15·6 ± 1·4	15·0 ± 1·5	16·0 ± 1·3

All measurements are expressed as percentages of the carapace length. The measurements are mean values, followed by standard deviations. N = number of observations.

Table 4 Female morphometric characters.

	C. fowleri sp. n.	*C. fowleri* form A	*C. discoveryi* sp. n.	*C. wolferi* sp. n.	*C. obtusa* sp. n.
N	46	10	20	21	23
H	46·7 ± 1·4	45·6 ± 0·7	47·8 ± 1·2	44·8 ± 2·3	46·7 ± 1·1
B	37·5 ± 1·1	40·5 ± 2·8	37·8 ± 1·6	38·6 ± 1·9	39·5 ± 1·7
F.O.: shaft	24·5 ± 1·2	24·6 ± 0·9	25·2 ± 0·9	25·7 ± 0·6	26·4 ± 0·5
capitulum	9·9 ± 0·9	10·4 ± 0·4	10·8 ± 0·4	11·2 ± 0·5	11·7 ± 0·5
total	34·6 ± 0·9	35·1 ± 0·7	35·9 ± 0·9	36·8 ± 0·8	38·1 ± 0·9
A1: segs 1 + 2	11·8 ± 0·4	11·8 ± 1·0	12·8 ± 0·7	13·0 ± 0·4	12·8 ± 0·6
a–d setae	16·5 ± 1·5	15·0 ± 1·4	17·5 ± 1·9	17·3 ± 1·3	17·6 ± 1·8
e setae	33·7 ± 0·8	33·4 ± 1·5	33·5 ± 1·9	34·9 ± 0·9	36·6 ± 1·2
A2: protop.	43·1 ± 0·6	42·0 ± 0·9	42·3 ± 0·7	45·4 ± 0·7	45·2 ± 0·8
Ex. 1	20·2 ± 0·4	21·4 ± 0·4	21·0 ± 0·4	20·3 ± 0·5	21·2 ± 0·4
Ex. 2–8	7·7 ± 0·2	7·5 ± 0·3	8·4 ± 0·4	8·1 ± 0·2	8·4 ± 0·4
LSS	42·1 ± 0·5	44·8 ± 0·8	45·8 ± 1·0	41·3 ± 0·8	43·4 ± 1·1
f–j setae	22·2 ± 1·1	23·1 ± 1·4	24·7 ± 1·5	22·0 ± 0·5	25·1 ± 1·7

All measurements are expressed as percentages of the carapace length. The measurements are mean values, followed by standard deviations. N = number of observations.

Table 5 Morphological details of five *skogsbergi* complex species.

	fowleri sp. n.	*discoveryi* sp. n.	*obtusa* sp. n.	*skogsbergi* SF	*skogsbergi* IF	*skogsbergi* LF	*wolferi* sp. n.
♂A1:							
b seta spines ant. side	5–11 : 5–10	6–11 : 8	7–9 : 4–10	7–9 : 4–9	9–11 : 6–9	12 : 11	8–14 : 3–9
b seta spines post. side	6–12	7	3–6	10–12	14–18	14	4–8
d seta spines ant. side	8–15 : 2–6	9–16 : 3–5	10–15 : 3–4	14–16 : 3–5	15–20 : 3–8	18–19 : 10	11–16 : 4–5
d seta spines post. side	–	–	–	6–7	5–8	8	–
e seta spines	24–30	20–25	23–28	26–28	28–31	30	24–28
♂A2:							
f seta spines	3–11	5–9	4–5	6–11	11–14	17	3–4
g seta spines	2–3	3–6	2–3	15–29	20–32	21–22	2–5
Penis muscle	3–5	2–5	4	3	4	5	4
♀A1:							
e seta spines ant. side	34–45	30–40	30–42	41–62	44–61	57–62	37–47
e seta spines post. side	30–37	25–37	37–41	40–56	40–65	50–61	37–44
Mandibular teeth:							
cutting edge	11–20	12–14	10–13	14–15	13	11–14	13–16
distal list	18–26	17–23	16–24	19–23	22–24	21–26	19–22
proximal list	18–26	17	17–20	24–25	24–27	22–23	14–18

The first range of numbers given for the ♂A1 b and d setae spines refers to the more proximal, closely spaced spines, the second range is for the more distal, widely spaced spines. Note that the ♂A1 f and g setae spines and some of the spines on the ♀A1 e seta and the ♂A1 b and d setae can be seen only by carefully examining these setae under high magnification. SF = small form; IF = intermediate form; LF = large form.

Table 6 Carapace length data (in mm) for *Conchoecia skogsbergi*.

Material	Provenance of material	Females N	Females Range	Females Mean ± SD	Males N	Males Range	Males Mean ± SD
Types	S. Atlantic	4	1·43–1·58	1·52	2	1·49–1·54	1·51
Gauss SF	Antarctic	19	1·34–1·45	1·38 ± 0·03	12	1·31–1·37	1·34 ± 0·02
Gauss IF	Antarctic	3	1·52–1·55	1·54	1	–	1·41
Gauss LF	Antarctic	2	1·60–1·61	1·60	2	–	1·66
Discovery SF	S. Atlantic	31	1·34–1·42	1·39 ± 0·02	14	1·32–1·42	1·35 ± 0·03
Discovery IF	S. Atlantic	13	1·46–1·52	1·47 ± 0·02	10	1·46–1·52	1·49 ± 0·02
Discovery LF	S. Atlantic	12	1·56–1·64	1·54 ± 0·07	1	–	1·66
Gauss SF	S.W. Indian	8	1·40–1·46	1·43 ± 0·02	–	–	–
Gauss IF	S.W. Indian	1	–	1·52	3	1·43–1·46	1·44
Gauss SF	S.E. Atlantic	2	1·46–1·47	1·46	–	–	–
Gauss IF	S.E. Atlantic	3	1·51–1·55	1·52	–	–	–
Discovery	N.E. Atlantic	11	1·46–1·54	1·50 ± 0·03	7	1·52–1·62	1·57 ± 0·03
Angel (1968*a*)	Norwegian Sea	1	–	1·34	–	–	–
Leung (1972, 1973)	Arctic	1	–	1·51	–	–	–
Total		111	1·34–1·64	1·45	52	1·31–1·62	1·44

N = number of observations; SD = standard deviation; SF = small form; IF = intermediate form; LF = large form. The *Gauss* specimens are from Müller's (1908) material of *C. rotundata*.

Table 7 *Conchoecia skogsbergi*: female morphometric characters for the three forms in *Discovery* material from the S. Atlantic.

	Small form	Intermediate form	Large form
N	10	8	10
H	50·1 ± 1·0	50·8 ± 0·7	50·6 ± 0·8
B	42·0 ± 1·2	41·0 ± 1·2	39·4 ± 1·6
F.O.: shaft	24·1 ± 0·5	24·3 ± 0·3	23·8 ± 0·8
capitulum	10·8 ± 0·8	11·0 ± 0·5	10·4 ± 0·4
total	34·9 ± 1·0	35·2 ± 0·5	34·1 ± 1·0
A1: segs 1 + 2	11·9 ± 0·8	12·0 ± 0·9	12·2 ± 1·0
a–d setae	14·6 ± 1·7	15·5 ± 1·5	15·5 ± 2·0
e seta	36·7 ± 1·2	36·7 ± 1·3	36·3 ± 1·2
A2: protop.	45·1 ± 0·6	45·2 ± 1·1	44·3 ± 0·9
Ex. 1	22·6 ± 0·6	22·6 ± 0·4	22·3 ± 0·6
Ex. 2–8	8·0 ± 0·3	7·6 ± 0·4	7·6 ± 0·2
LSS	48·6 ± 1·6	46·9 ± 0·8	47·2 ± 0·8
f–j setae	22·0 ± 2·1	22·9 ± 1·6	23·3 ± 1·8

All measurements are expressed as percentages of carapace length. The measurements are mean values, followed by standard deviation. N = number of observations.

Table 8 *Conchoecia skogsbergi:* male morphometric characters for the three forms in *Discovery* material from the S. Atlantic.

	Small form	Intermediate form	Large form
N	14	10	1
H	49·5 ± 0·6	49·1 ± 1·1	50·0
B	44·9 ± 1·5	43·8 ± 0·8	–
F.O.: shaft	30·2 ± 0·5	30·8 ± 0·8	33·8
capitulum	12·1 ± 0·5	12·3 ± 0·3	11·9
total	42·4 ± 1·1	43·1 ± 1·0	45·7
A1: seg. 1	15·0 ± 0·3	14·6 ± 0·4	14·7
seg. 2	20·4 ± 0·3	19·8 ± 0·5	20·9
total	35·4 ± 0·3	34·6 ± 0·8	34·0
a seta	22·0 ± 1·5	28·1 ± 2·9	21·8
b seta	46·7 ± 1·3	48·4 ± 1·0	49·7
c seta	3·2 ± 0·2	3·8 ± 0·5	3·4
d seta	48·0 ± 0·9	50·6 ± 1·2	51·6
e seta	57·1 ± 1·1	62·1 ± 0·9	62·1
A2: protop.	49·5 ± 0·5	49·9 ± 0·7	48·9
Ex. 1	23·1 ± 1·1	23·2 ± 0·5	28·1
Ex. 2–8	7·8 ± 0·4	8·1 ± 0·2	7·0
LSS	58·9 ± 1·7	56·5 ± 1·2	56·6
f seta	43·8 ± 0·6	40·5 ± 0·9	42·7
g seta	48·3 ± 1·1	44·6 ± 1·7	47·9
h–j seta	12·8 ± 2·2	15·0 ± 3·0	14·4

All measurement are expressed as percentages of carapace length. The measurements are mean values, followed by standard deviations. N = number of observations.

Table 9 Left asymmetric gland positions.

Species	Provenance of material	Females N	Mean ± SD	Males N	Mean ± SD
C. fowleri sp. nov.	53°N, 20°W	20	13·6 ± 0·5	20	13·8 ± 0·7
C. fowleri sp. nov.	11°N, 20°W	16	13·4 ± 1·0	17	12·7 ± 0·7
C. fowleri form A	11°N, 20°W	13	14·2 ± 0·8	13	13·9 ± 0·6
C. discoveryi sp. nov.	53°N, 20°W	21	17·7 ± 1·0	20	17·9 ± 0·7
C. obtusa sp. nov.	40°N, 20°W	20	12·2 ± 0·9	20	11·7 ± 0·5
C. skogsbergi types	S. Atlantic	3	12·2	1	11·9
C. skogsbergi SF	S. Atlantic	23	13·7 ± 0·7	11	13·3 ± 0·4
C. skogsbergi IF	S. Atlantic	9	14·1 ± 0·7	7	12·9 ± 0·4
C. skogsbergi LF	S. Atlantic	7	13·0 ± 0·5	–	–
C. skogsbergi	11°N, 20°W	5	12·2	4	11·9
C. skogsbergi	Arctic (86°N)	1	12·6	–	–
C. wolferi sp. nov.	11°N, 20°W	47	11·0 ± 0·6	42	10·7 ± 0·5
C. acuta sp. nov.	18°N, 25°W	22	9·8 ± 0·7	20	10·5 ± 0·5
C. australis sp. nov.	39°S, 00°E	10	12·7 ± 1·9	9	10·7 ± 0·7
C. inflata sp. nov.	30°N, 23°W	20	10·8 ± 0·5	20	10·7 ± 0·5
C. rotundata	30°N, 23°W	21	8·9 ± 0·7	22	9·3 ± 0·6
C. subinflata sp. nov.	60°N, 20°W	20	9·7 ± 0·7	20	9·7 ± 0·7

The gland positions are expressed as percentages of the carapace length behind the tip of the rostrum. The Arctic specimen of *C. skogsbergi* is that of Leung (1972, 1973), SF = small form; IF = intermediate form; LF = large form; N = number of observations; SD = standard deviation.

Table 10 Carapace length (L) height (H) and breadth (B) data for the narrow and broad forms of *C.* aff. *acuta.*

Females

Narrow form			Narrow form (*Gauss* material)			Broad form		
N	Range	Mean ± SD	N	Range	Mean ± SD	N	Range	Mean ± SD
L 18	0·84–0·93	0·89 ± 0·03	8	0·90–0·96	0·93 ± 0·02	174	0·87–0·97	0·93 ± 0·02
H 15	43·1–50·9	47·49 ± 2·08	7	45·90–49·18	47·52 ± 1·14	31	45·90–50·00	48·17 ± 1·13
B 15	32·79–44·83	38·93 ± 3·04	4	33·33–40·98	35·85	31	41·37–54·39	45·94 ± 3·31

Males

Narrow form			Broad form		
N	Range		N	Range	Mean ± SD
L 2	0·85–0·94		80	0·85–0·95	0·90 ± 0·02
H 2	44·64–51·61		22	42·37–48·28	46·02 ± 1·40
B 2	44·64–47·90		22	47·32–57·89	51·46 ± 2·65

Height and breadth are expressed as percentages of the carapace length. N = number of observations; SD = standard deviation. Except where indicated, the specimens are from Poulsen's (1973) *Dana* material of *Metaconchoecia rotundata.* The *Gauss* material is from Müller's (1908) material of *C. rotundata.*

Table 11 Male morphometric characters.

	C. acuta sp. n.	*C. australis* sp. n.	*C. inflata* sp. n.	*C. rotundata*	*C. subinflata* sp. n.
N	41	9	30	20	42
H	46·2 ± 1·3	50·6 ± 1·1	48·0 ± 1·0	47·7 ± 1·4	46·5 ± 0·9
B	48·0 ± 2·6	48·9	53·0 ± 2·1	44·5 ± 2·0	46·4 ± 2·2
F.O.: shaft	30·5 ± 0·6	33·1 ± 0·6	29·3 ± 0·4	29·8 ± 0·74	30·1 ± 0·6
capitulum	12·5 ± 0·5	12·4 ± 0·4	13·4 ± 0·2	12·1 ± 0·6	12·2 ± 0·5
total	42·9 ± 0·8	45·5 ± 0·6	42·7 ± 0·7	41·9 ± 0·2	42·3 ± 1·0
A1: seg 1	15·9 ± 0·4	16·1 ± 1·0	15·5 ± 0·4	15·1 ± 0·2	14·8 ± 0·3
seg 2	18·8 ± 0·4	20·3 ± 0·4	18·5 ± 0·4	18·6 ± 0·6	19·0 ± 0·8
total	34·8 ± 0·5	36·6 ± 1·0	34·0 ± 0·7	33·8 ± 0·8	34·0 ± 0·9
a seta	25·1 ± 2·5	22·4 ± 3·8	26·8 ± 2·1	27·6 ± 2·2	25·2 ± 1·6
b seta	43·9 ± 1·1	49·5 ± 1·0	46·1 ± 0·9	43·8 ± 1·0	44·1 ± 0·8
c seta	3·3 ± 0·4	3·1 ± 0·4	3·5 ± 0·7	4·0 ± 0·4	4·0 ± 0·4
d seta	45·6 ± 0·9	50·9 ± 1·3	48·2 ± 1·0	45·4 ± 0·9	46·1 ± 0·8
e seta	56·5 ± 0·9	58·7 ± 1·1	60·0 ± 1·2	52·4 ± 1·4	54·3 ± 1·0
A2: protop.	51·7 ± 0·8	53·1 ± 1·6	50·8 ± 0·8	49·4 ± 0·8	49·7 ± 0·9
Ex. 1	21·1 ± 0·5	24·8 ± 0·5	23·3 ± 0·6	21·8 ± 0·5	21·8 ± 0·5
Ex. 2–8	9·0 ± 0·3	9·2 ± 0·3	9·1 ± 0·3	8·8 ± 0·4	8·8 ± 0·3
LSS	51·4 ± 0·9	62·1 ± 1·1	56·6 ± 1·2	51·7 ± 0·9	55·0 ± 1·2
f seta	36·9 ± 1·0	43·7 ± 1·4	39·2 ± 1·2	39·2 ± 0·8	40·8 ± 1·2
g seta	40·2 ± 1·2	47·9 ± 1·9	43·2 ± 1·2	42·5 ± 0·8	44·4 ± 1·2
h–j seta	13·6 ± 1·1	13·2 ± 1·2	14·5 ± 1·1	15·3 ± 1·4	13·8 ± 1·0

All measurements are expressed as percentages of the carapace length. The measurements are mean values, followed by standard deviations. N = number of observations.

Table 12 Female morphometric characters.

	C. acuta sp. n.	*C. australis* sp. n.	*C. inflata* sp. n.	*C. rotundata*	*C. subinflata* sp. n.
N	42	4–7	30	20	31
H	46·9 ± 1·0	53·4 ± 1·9	49·9 ± 1·1	48·5 ± 1·0	48·7 ± 1·0
B	41·9 ± 1·8	45·9	49·5 ± 2·1	40·1 ± 2·4	38·0 ± 1·6
F.O.: shaft	26·8 ± 0·9	23·3	26·3 ± 0·7	25·0 ± 0·5	25·7 ± 0·6
capitulum	12·0 ± 0·6	10·8 ± 0·6	12·0 ± 0·5	11·8 ± 0·4	12·5 ± 0·5
total	36·8 ± 1·0	34·0	38·3 ± 0·6	36·8 ± 0·6	36·7 ± 0·7
A1: segs 1 + 2	15·0 ± 0·4	11·9	15·0 ± 0·7	13·3 ± 0·4	12·8 ± 0·5
a–d setae	16·6 ± 1·2	14·9 ± 0·9	17·7 ± 1·2	17·7 ± 1·8	17·4 ± 1·4
e seta	31·1 ± 0·8	36·7 ± 0·8	35·4 ± 0·8	32·8 ± 1·1	35·3 ± 0·7
A2: protop.	46·4 ± 0·7	47·2 ± 0·8	46·5 ± 0·6	43·4 ± 0·8	45·4 ± 0·8
Ex. 1	20·2 ± 0·4	23·1 ± 0·4	22·7 ± 0·4	20·3 ± 0·9	20·8 ± 0·5
Ex. 2–8	8·4 ± 0·3	8·5 ± 0·5	8·9 ± 0·3	8·4 ± 0·3	8·4 ± 0·2
LSS	38·7 ± 0·9	48·7 ± 0·8	43·6 ± 0·6	40·8 ± 0·8	43·2 ± 1·1
f–j setae	18·6 ± 0·9	23·6 ± 1·9	23·1 ± 1·2	22·5 ± 1·6	22·5 ± 1·1

All measurements are expressed as percentages of the carapace length. The measurements are means, followed by standard deviations. N = number of observations.

Table 13 Morphological details of five *skogsbergi* complex species.

	C. acuta sp. n.	*C. australis* sp. n.	*C. inflata* sp. n.	*C. rotundata*	*C. subinflata* sp. n.
♂A1:					
b seta spines: ant. side	7–10 : 4–7	9–12 : 3–8	6–11 : 5–12	6–8 : 4–7	6–11 : 4–11
post. side	6–13	12–18	3–11	1–2	7–8
d seta spines	9–15 : 3–7	11–17 : 3–4	8–13 : 2–5	9–12 : 3–4	8–17 : 3–5
e seta spines	20–24	20–23	19–26	14–18	18–22
♂A2:					
f seta spines	1–2	3–5	2–3	2–5	3–5
g seta spines	0–5	1–4	4–7	0–3	2–3
Penis muscles	2–4	5	2–6	4–5	5
♀A1:					
e seta spines: ant. side	20–23	36–40	34–44	20–33	31–45
post. side	25–35	35–42	28–38	25–35	25–35
Mandibular teeth:					
cutting edge	12–14	14–16	11–15	12–14	13–15
distal list	18–20	20–21	17–22	18–20	17–25
proximal list	15–20	15–18	20–25	15–20	20–21

The first range of numbers given for ♂A1 b and d setae refers to the more proximal, closely spaced spines, the second range is for the more distal, widely spaced spines. Note that the ♂A1 f and g seta spines and some of the spines on the ♀A1 e seta and the ♂A1 b and d setae can be seen only be carefully examining these setae under high magnification.

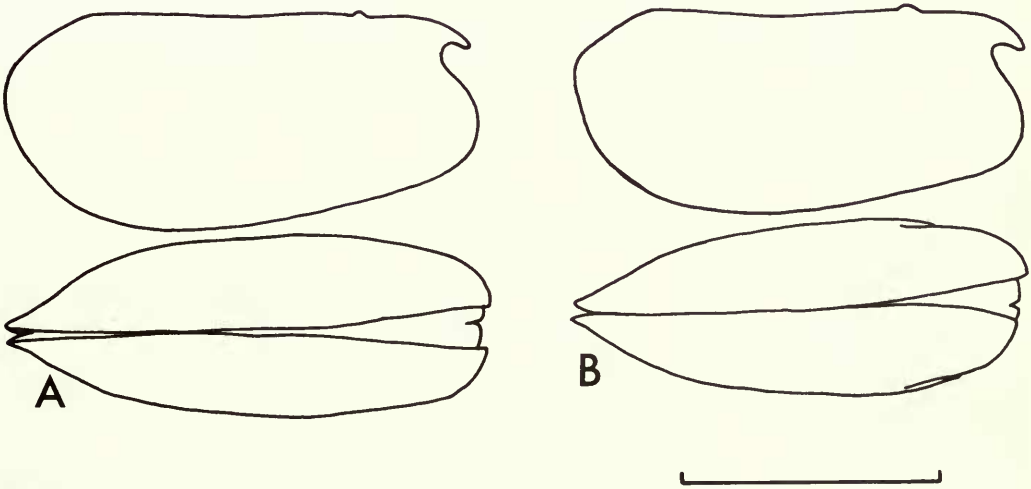

Fig. 2 Lateral and ventral carapace outlines, *Conchoecia glandulosa*, Station 9756 haul 7: A, ♀; B, ♂. Scale 1·0 mm.

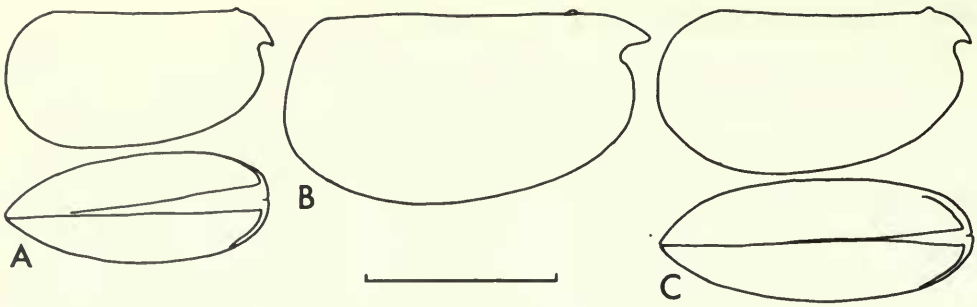

Fig. 3 Lateral and ventral carapace outlines: A, *Conchoecia skogsbergi* ♂, Station 2501; B, *C. abyssalis* ♂ (after Rudyakov, 1962); C, *C. skogsbergi* ♀, 2501. Scale 1·0 mm.

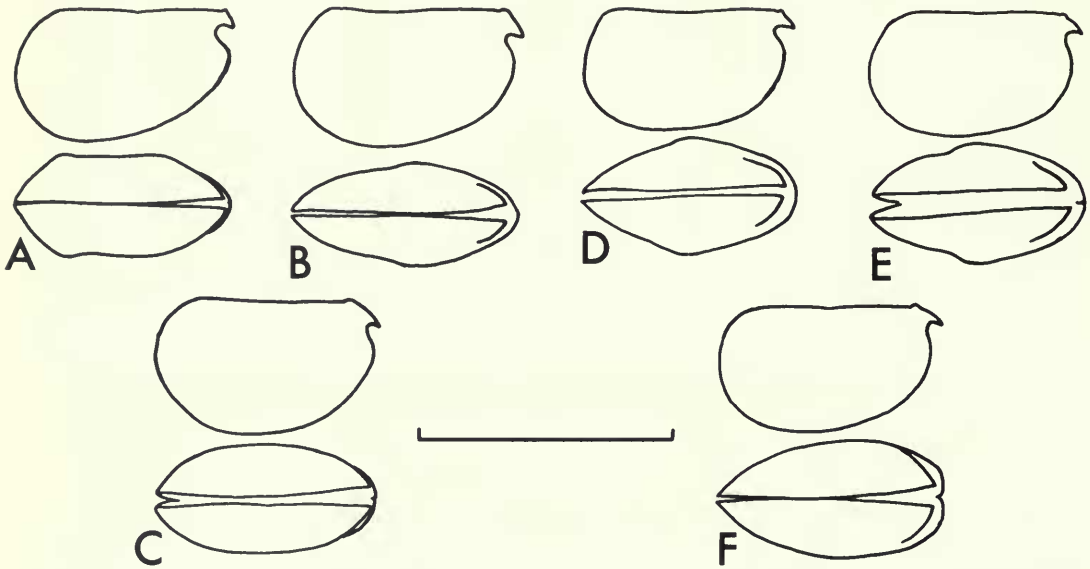

Fig. 4 Lateral and ventral carapace outlines: A, *Conchoecia nasotuberculata* ♀, Station 6665 haul 6; B, *C. kyrtophora* ♀, 6665 haul 33; C, *C. teretivalvata* ♀, 7709 haul 2; D, *C. nasotuberculata* ♂, 6665 haul 6; E, *C. kyrtophora* ♂, 6665 haul 6; F, *C. teretivalvata* ♂, 7709 haul 2. Scale 1·0 mm.

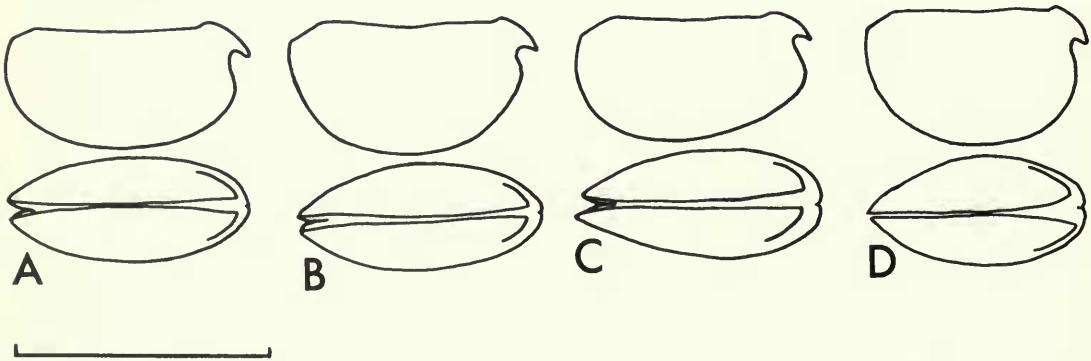

Fig. 5 Lateral and ventral carapace outlines: A, *Conchoecia pusilla* ♀, Station 7486; B, *C. isochiera* ♀, 1781; C, *C. pusilla* ♂, 7481; D, *C. isochiera* ♂, 1781. Scale 1·0 mm.

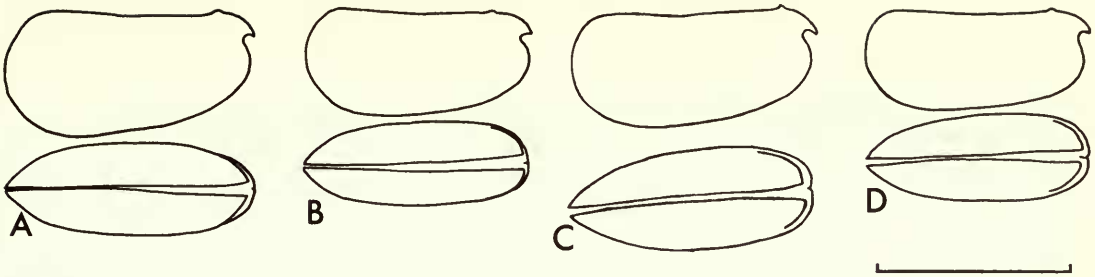

Fig. 6 Lateral and ventral carapace outlines: A, *Conchoecia fowleri* sp. nov. ♀, Station 7711 haul 32; B, *C. discoveryi* sp. nov. ♀, 7709 haul 63; C, *C. fowleri* sp. nov. ♂, 7711 haul 32; D, *C. discoveryi* sp. nov. ♂, 7709 haul 35. Scale 1·0 mm.

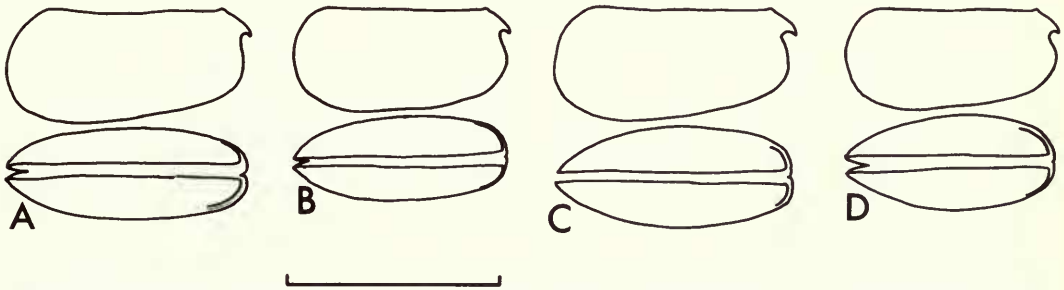

Fig. 7 Lateral and ventral carapace outlines: A, *Conchoecia wolferi* sp. nov. ♀, Station 6665 haul 4; B, *C. obtusa* sp. nov. ♀, 7856 haul 2; C, *C. wolferi* sp. nov. ♂, 6665 haul 4; D, *C. obtusa* sp. nov. ♂, 6665 haul 4. Scale 1·0 mm.

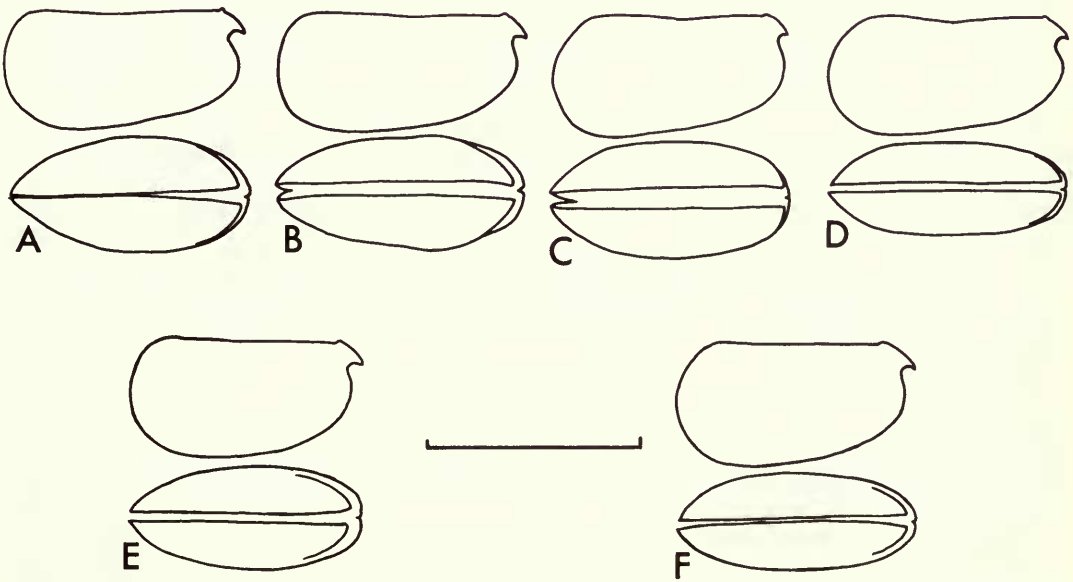

Fig. 8 Lateral and ventral carapace outlines: A, *Conchoecia inflata* sp. nov. ♂, Station 7856 haul 21; B, *C. subinflata* sp. nov. ♂, 7711 haul 23; C, *C. inflata* ♀, 7856 haul 21; D, *C. subinflata* sp. nov. ♀, 7711 haul 23; E, *C. australis* sp. nov. ♂, *Gauss* Station 18.12.01; F, *C. australis* sp. nov. ♀, *Gauss* Station 18.12.01. Scale 1·0 mm.

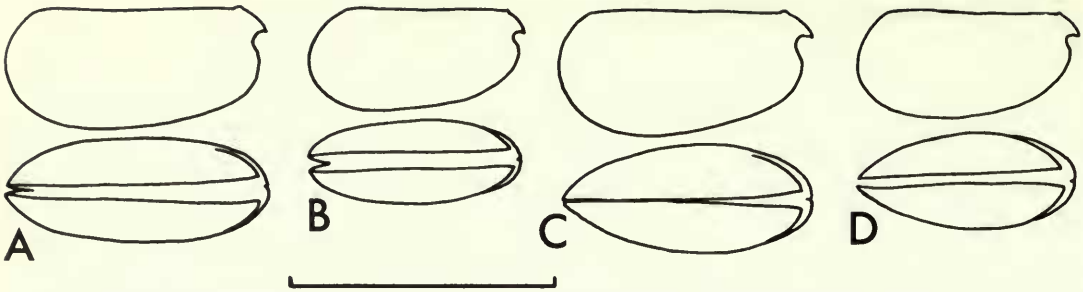

Fig. 9 Lateral and ventral carapace outlines: A, *Conchoecia acuta* sp. nov. ♀, Station 7089 haul 19; B, *C. rotundata* ♀, 7856 haul 18; C, *C. acuta* sp. nov. ♂, 7089 haul 19; D, *C. rotundata*, 7856 haul 72. Scale 1·0 mm.

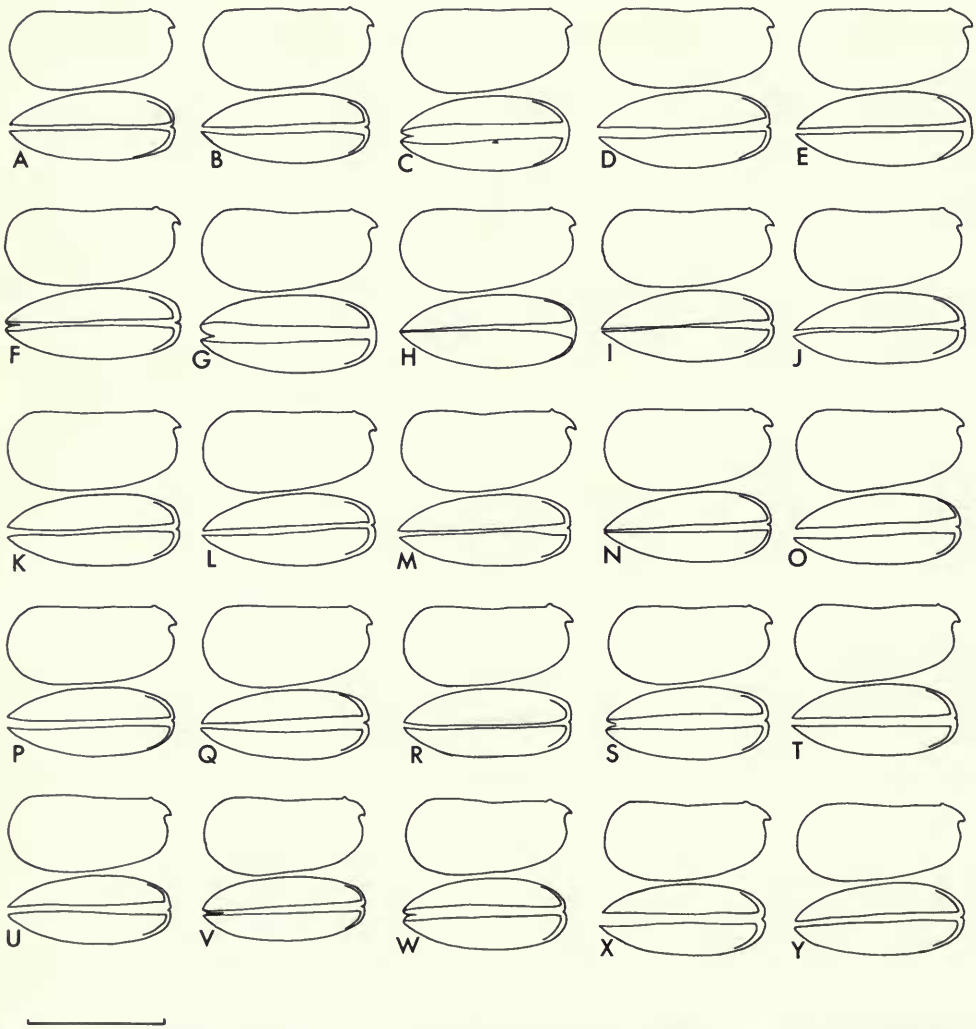

Fig. 10 *Conchoecia fowleri* sp. nov. ♂♂, lateral and ventral carapace outlines: A–F, Station 7709 haul 3; G, H, 7709 haul 36; I, K–M, 7711 haul 32; J, 7711 haul 6; N, O, 7406 haul 24; P–R, 7406 haul 44; S, 7856 haul 4; T, 7856 haul 10; U–Y, 7856 haul 13. Scale 1·0 mm.

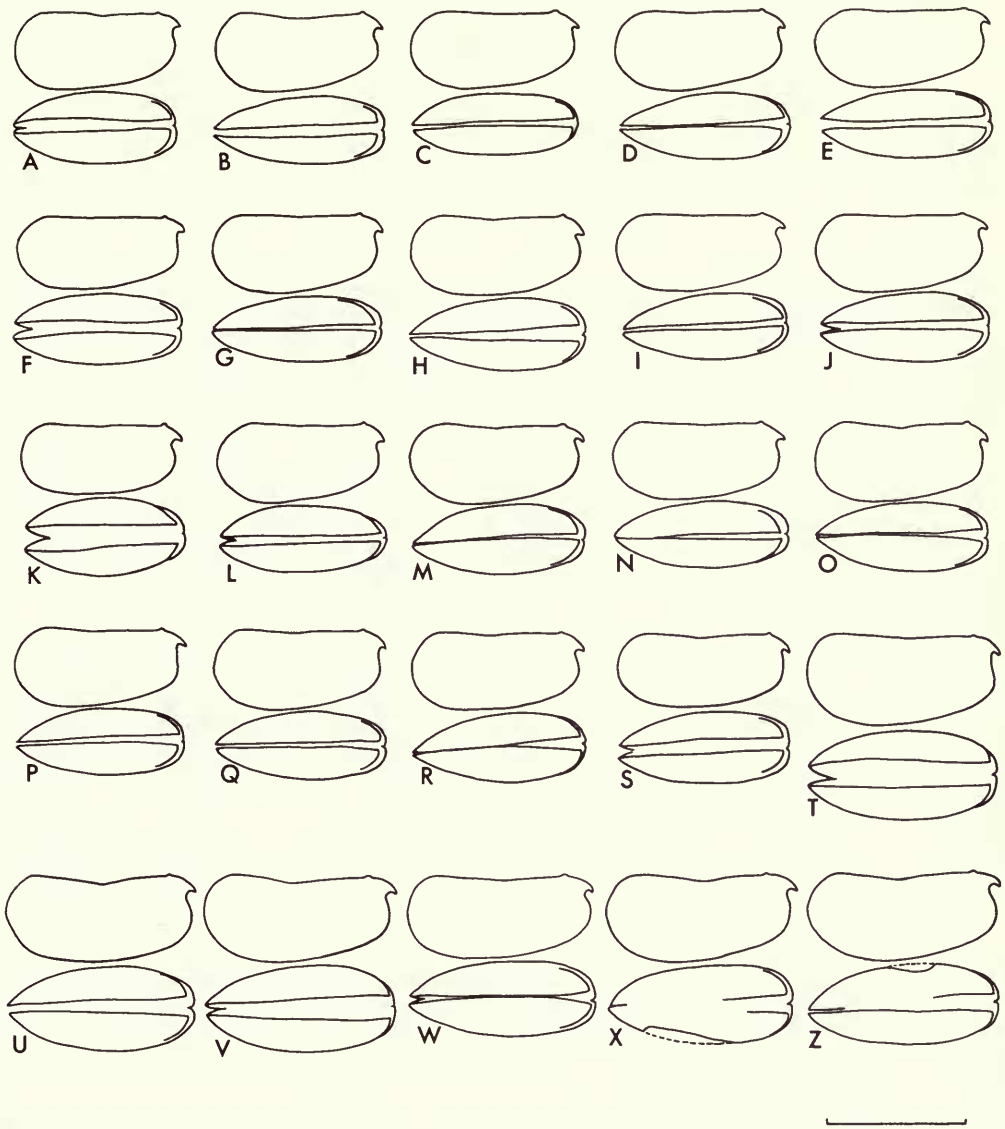

Fig. 11 Lateral and ventral outlines of male carapaces: A–S, *Conchoecia fowleri* sp. nov.; A, B, Station 7089 haul 4; C–J, 7089 haul 14; K, L, R, S, 6665 haul 27; M–Q, 6665 haul 22: T–Z, *Conchoecia fowleri* form A: T, 7803 haul 11; U, X–Z, 6665 haul 26; V, 6665 haul 24; Scale 1·0 mm.

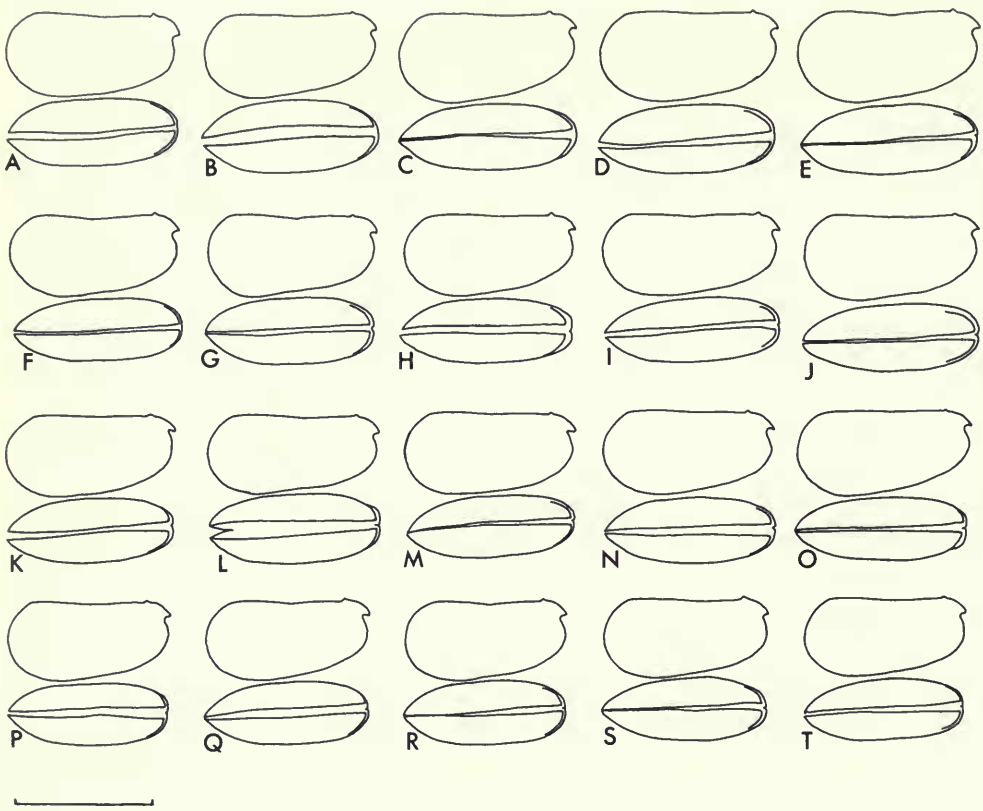

Fig. 12 *Conchoecia fowleri* sp. nov. ♀♀, lateral and ventral carapace outlines: A–E, Station 7709 haul 36; F–J, 7711 haul 32; K, N, O, 7406 haul 24; L, 7406 haul 27; M, 7406 haul 44; P, 7856 haul 4; Q–T, 7856 haul 13. Scale 1·0 mm.

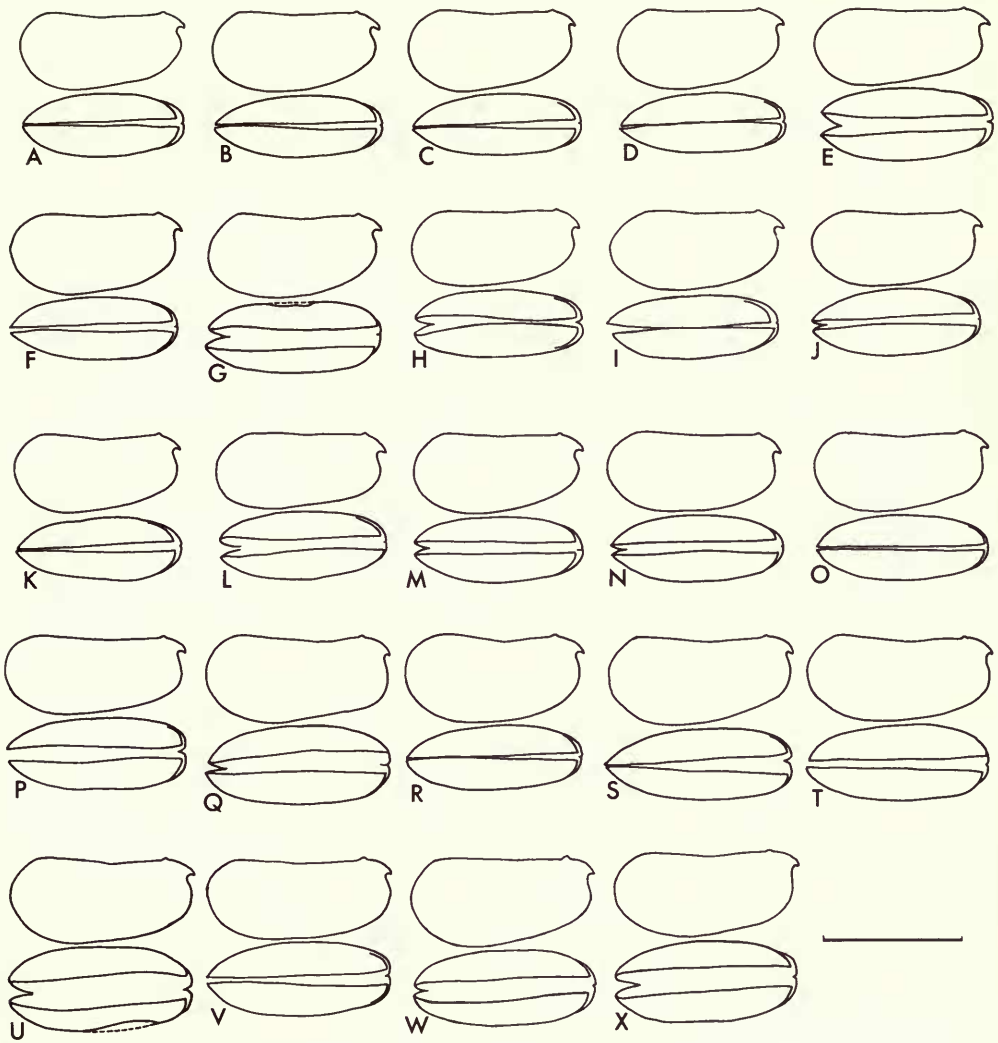

Fig. 13 Lateral and ventral outlines of female carapaces: A–O, *Conchoecia fowleri* sp. nov.; A–D, F, H, I, Station 7089 haul 14; E, G, 7089 haul 34; J, N, O, 6665 haul 23; K–M, 6665 haul 21: P–X, *Conchoecia fowleri* form A; P, 6665 haul 28; Q, 6665 haul 24; R, V, 6665 haul 21; S, 6665 haul 32; T, U, 6665 haul 26; W, X, 7089 haul 7. Scale 1·0 mm.

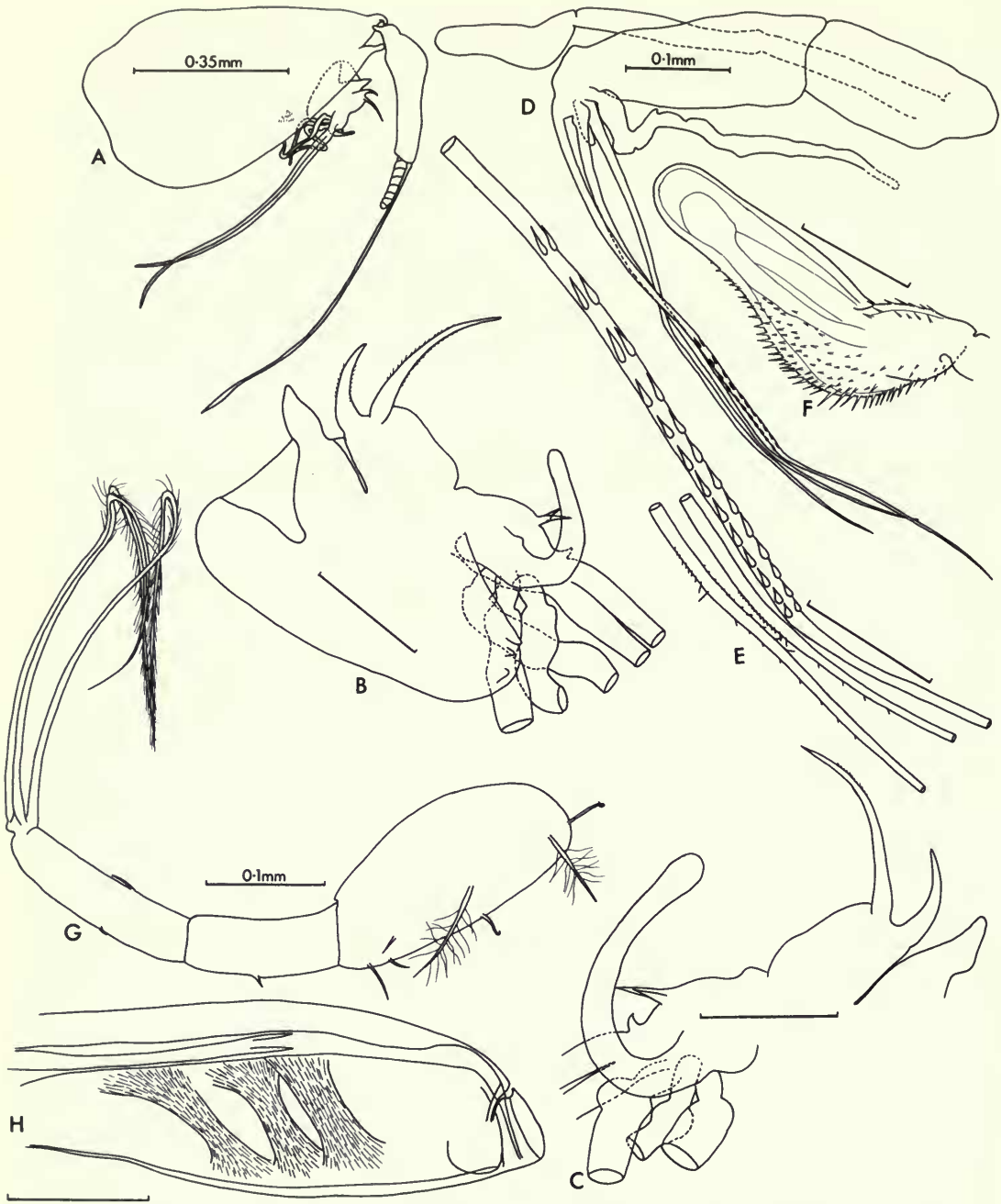

Fig. 14 Male dimorphic parts of *Conchoecia fowleri* sp. nov., all are from the holotype BM(NH) reg. no. 1979.695: A, second antenna; B, endopodite of left second antenna; C, part of right second antenna endopodite; D, first antenna and frontal organ; E, armature of b, d and e setae on first antenna; F, frontal organ capitulum; G, sixth limb; H, penis. Scales 0·05 unless otherwise indicated.

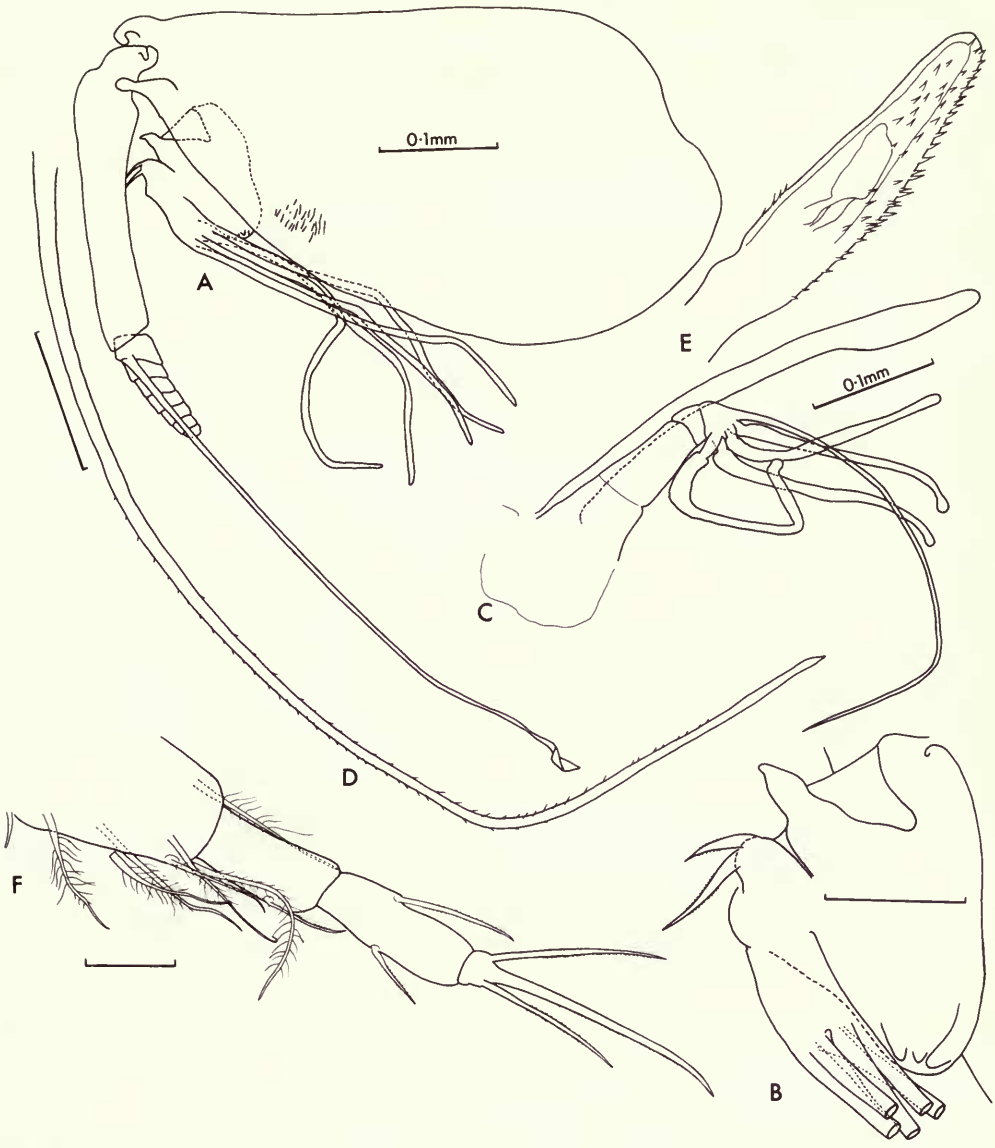

Fig. 15 Female dimorphic parts of *Conchoecia fowleri* sp. nov.: A, second antenna; B, second antenna endopodite; C, first antenna and frontal organ; D, first antenna e seta; E, frontal organ capitulum; F, sixth limb. Scales 0·05 mm unless otherwise indicated.

Fig. 16 Non-dimorphic parts of *Conchoecia fowleri*, E–I are from the holotype BM(NH) reg. no. 1979.695: A, labrum; B, mandible; C, cutting edge and adjacent setae of mandibular basale; D, E, cutting edge, distal and proximal tooth lists of mandibular coxale; F, fifth limb; G, maxilla; H, caudal furca; I, seventh limb. Scales 0·05 mm unless otherwise indicated. Lower right scale refers to Figs A, C–E, G, I.

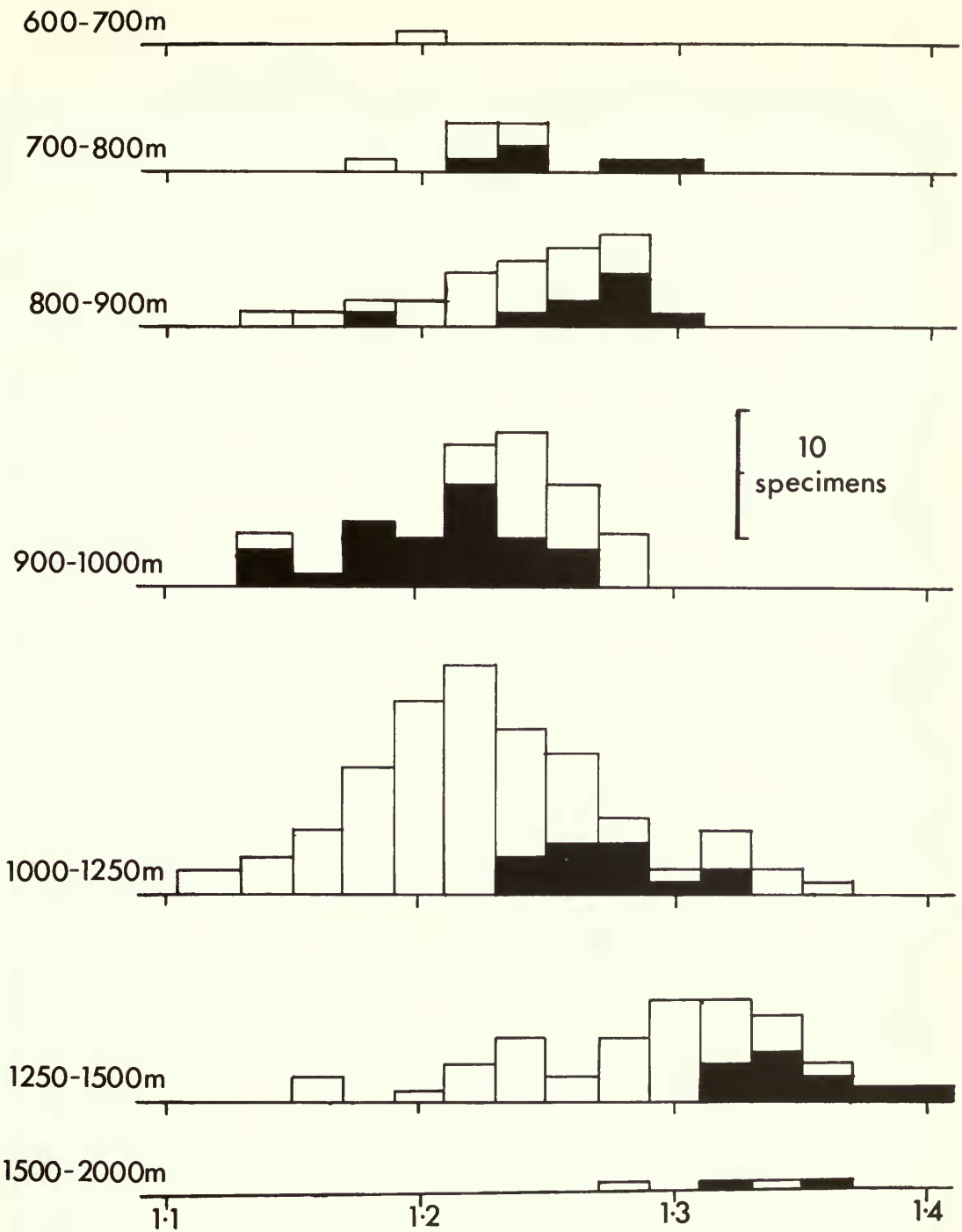

Fig. 17 *Conchoecia fowleri* sp. nov. and *C. fowleri* form A. Carapace length (in mm) plotted against water depth at the equator (GATE stations). The larger (> 1·30 mm) specimens occurring below 1000 m are assigned to *C. fowleri* form A. The broad length ranges between 1000 m and 1500 m suggest hybridization. Males black, females white.

Fig. 18 Variability in the outline of the male frontal organ capitulum: A–J, *Conchoecia fowleri* sp. nov.; A, Station 7856 haul 10; B–E, 7711 haul 32; F, 7089 haul 14; G, 6665 haul 23; H, 6665 haul 26; I, 6665 haul 27; J, 6665 haul 20: K–P *Conchoecia skogsbergi*; K, small form, 2393; L, small form, 2498; M, small form, 2501; N, intermediate form, 1776; O, intermediate form, 1778; P, large form, 1781. Scale 0·05 mm.

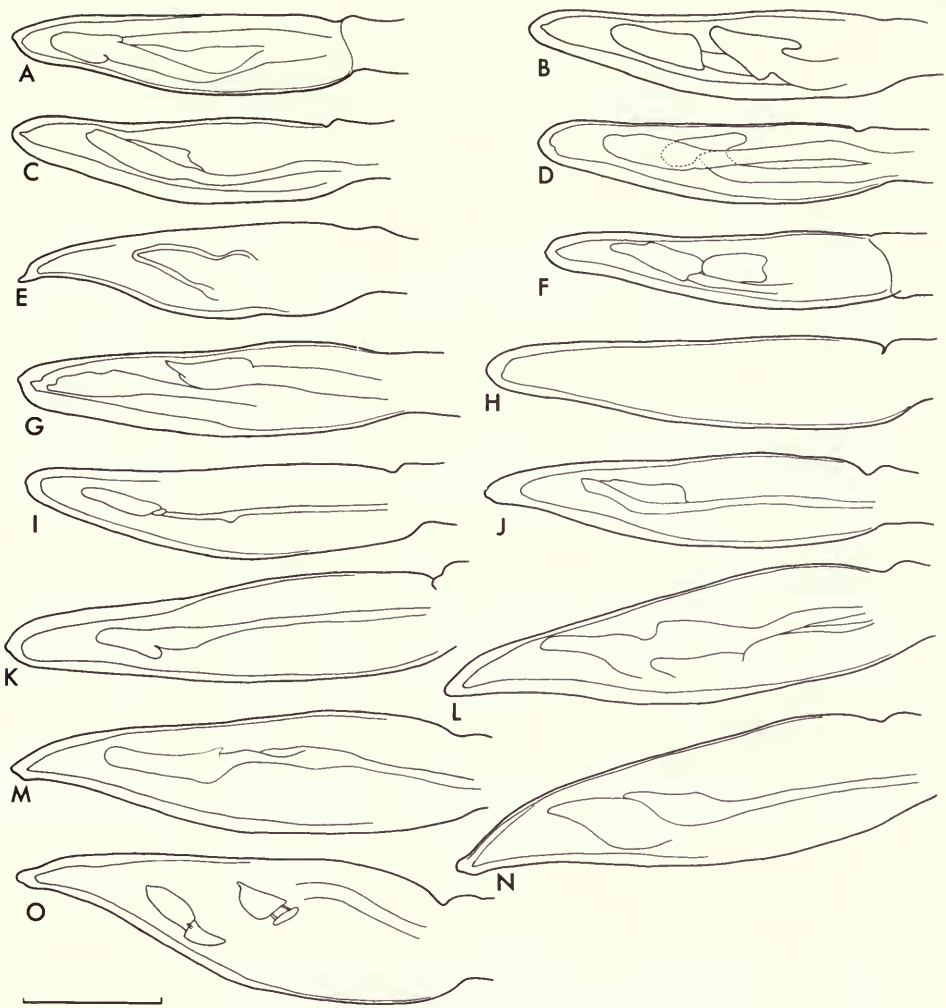

Fig. 19 Variability in the outline of the female frontal organ capitulum: A–I, *Conchoecia fowleri*, sp. nov.; A–D, F, Station 7711 haul 32; E, 7089 haul 4; G, 6665 haul 32; H, I, 6665 haul 23: J–O, *Conchoecia skogsbergi*; J small form, 2018; K, intermediate form, 1779; L, large form, 1782; M, large form, 1781; N, large form, 2020; O, large form, 2498. Scale 0·05 mm.

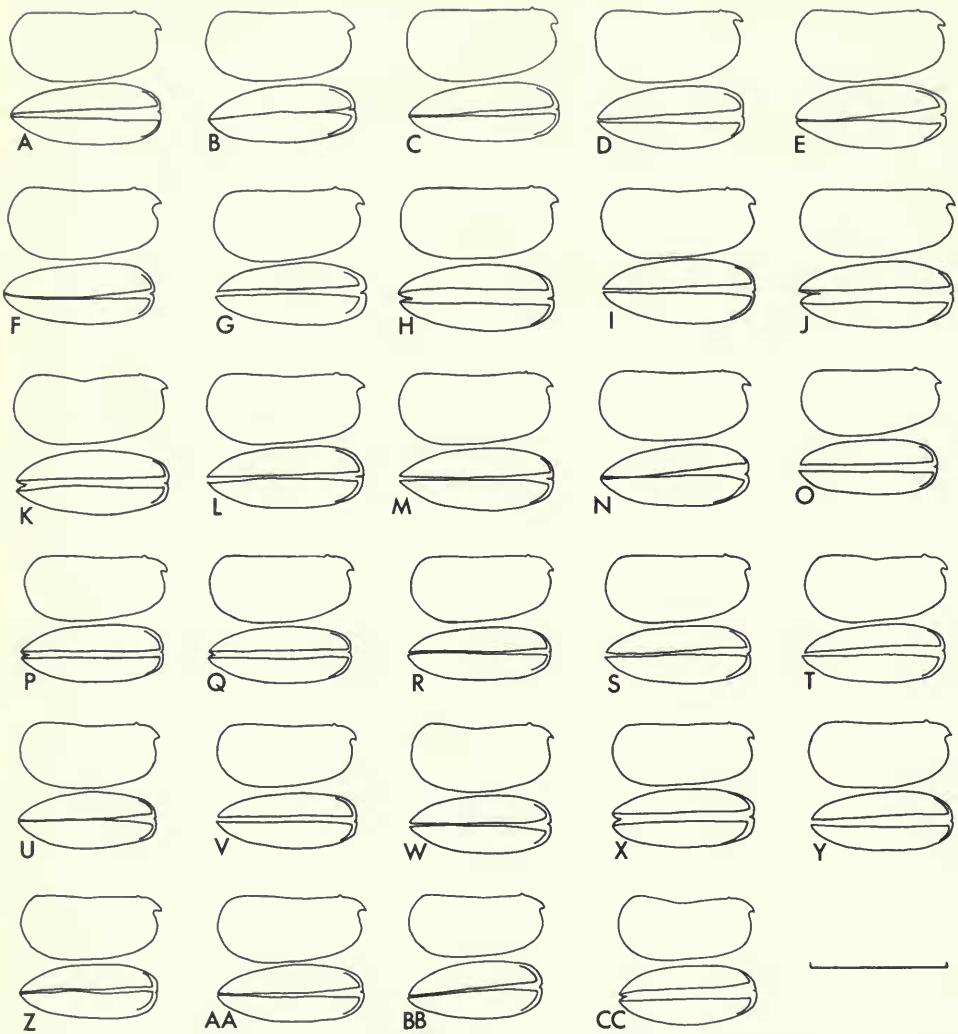

Fig. 20 *Conchoecia discoveryi* sp. nov. ♂♂, lateral and ventral carapace outlines: A, B, Station 7711 haul 25; C, 7711 haul 15; D–G, 7711 haul 9; H, J, K, N, 7709 haul 63; I, 7709 haul 55; L, M, 7709 haul 35; O, 7406 haul 1; P, S, 7406 haul 22; Q, R, 7406 haul 6; T, 7856 haul 48; U, Z, 7089 haul 12; V, X, 7089, haul 5; W, 7089 haul 11; Y, AA, 7856 haul 48; BB, CC, 6665 haul 13. Scale 1·0 mm.

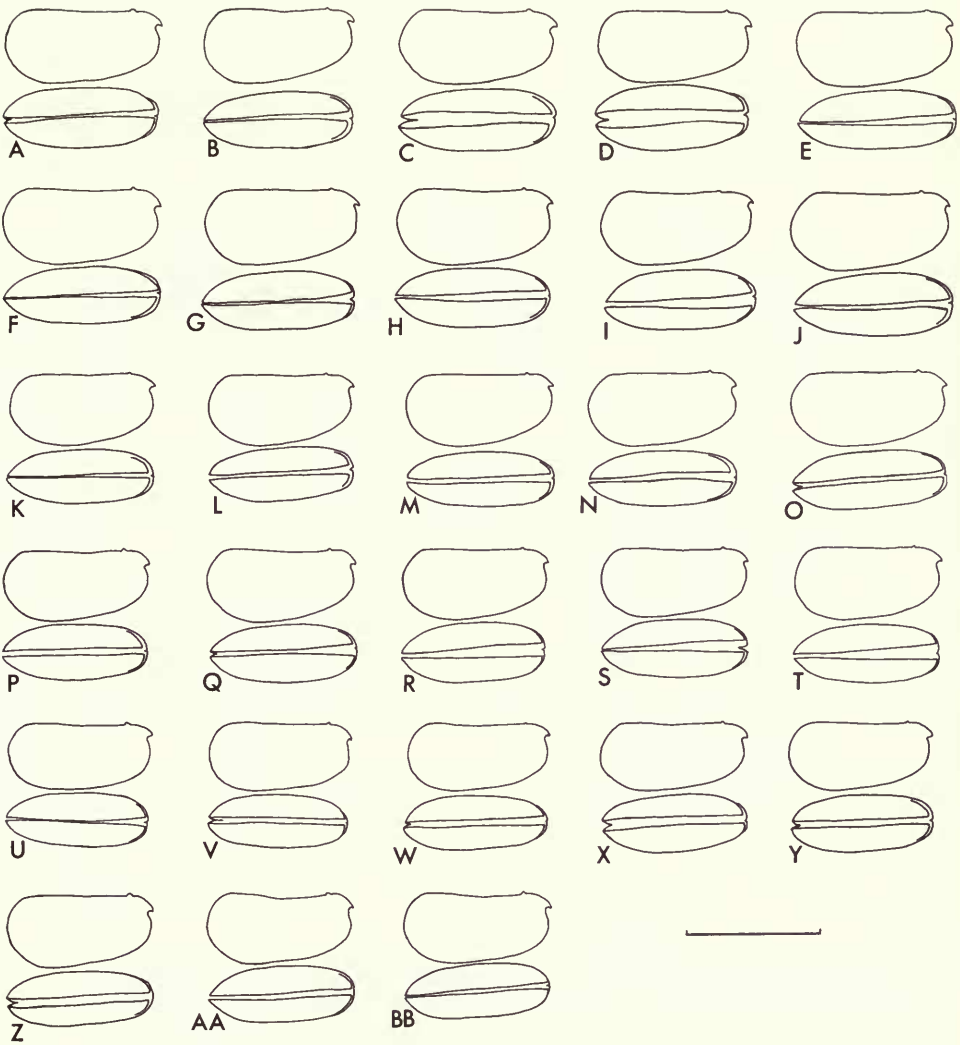

Fig. 21 *Conchoecia discoveryi* sp. nov. ♀♀, lateral and ventral carapace outlines: A–F, Station 7709 haul 76; G–J, 7711 haul 32; K, M, 7406 haul 22: L, N, O, 7406 haul 6; P–R, 7856 haul 48; S, T, 7856 haul 50; U, X, Y, 7089 haul 12; V, W, 7089 haul 4; Z, 7089 haul 15; AA, BB 6665 haul 19. Scale 1·0 mm.

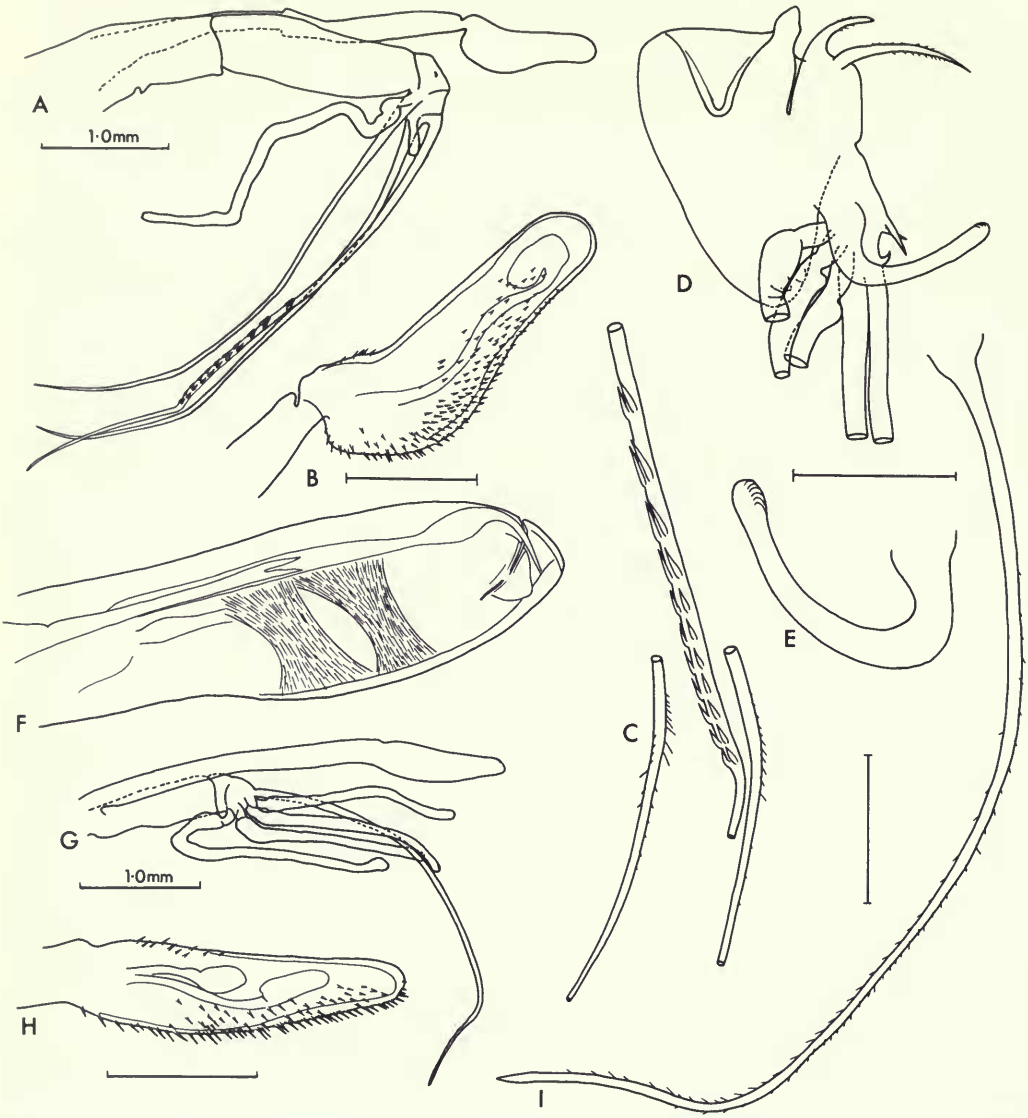

Fig. 22 *Conchoecia discoveryi* sp. nov., male and female dimorphic parts, A–C, F, holotype BM(NH) reg. no. 1979.693; G–I, paratype BM(NH) reg. no. 1979.694: A, ♂ first antenna; B, ♂ frontal organ capitulum; C, ♂ first antenna b, d, e setae armatures; D, ♂ second antenna, left endopodite; E, right hook appendage; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum; I, ♀ first antenna e seta. Scales 0·05 mm unless stated otherwise.

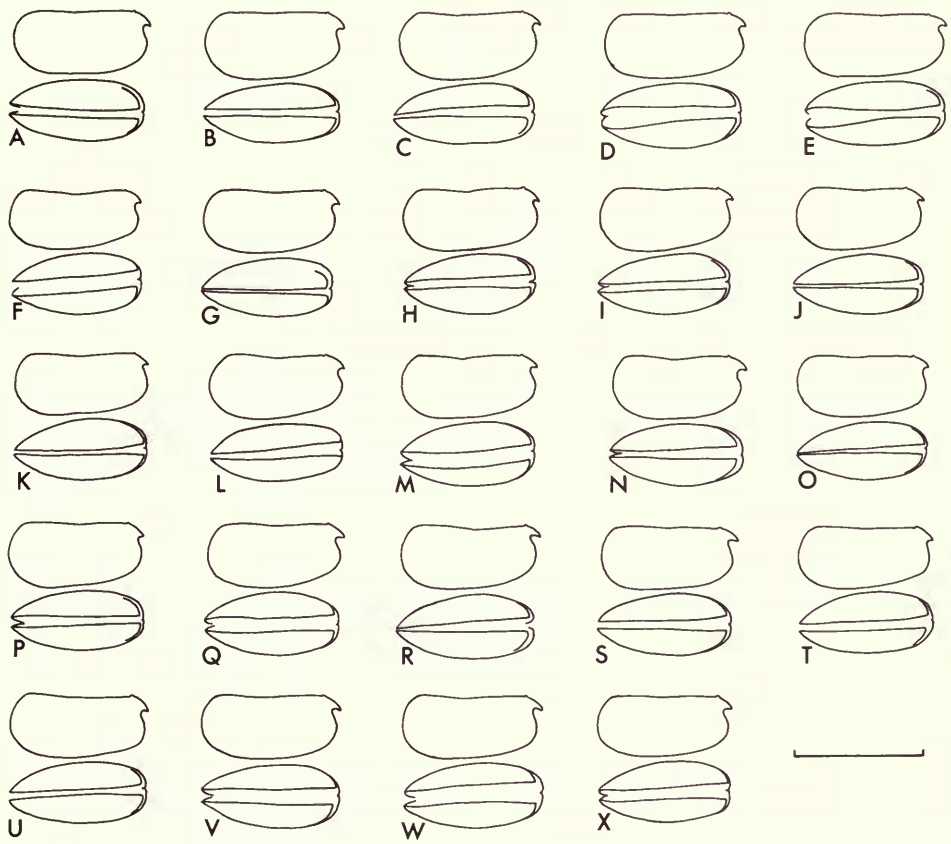

Fig. 23 *Conchoecia obtusa* sp. nov. ♂♂, lateral and ventral carapace outlines: A, B, Station 7406 haul 32; C, D, 7406, haul 24; E, 7406 haul 25; F, J–L, 7856 haul 8; G–I, M, N, 7856 haul 2; O, P, 8272; Q, 8264; R–U, 8281 haul 13; V–X, 7089 haul 29. Scale 1·0 mm.

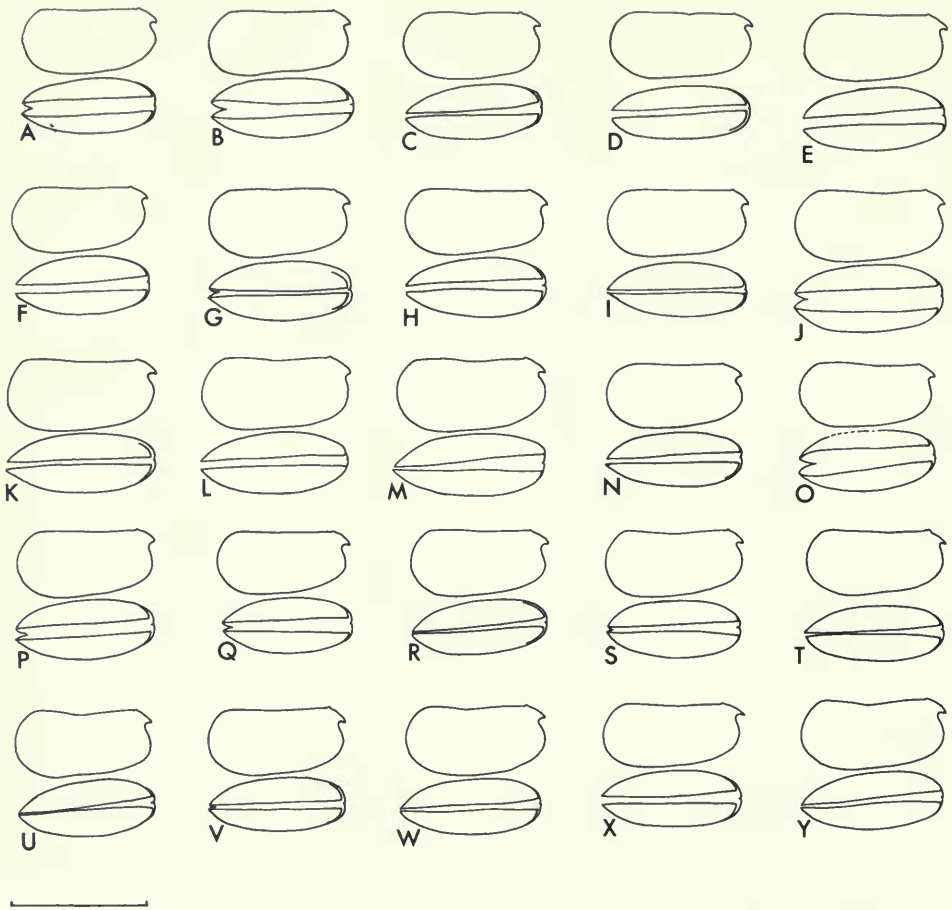

Fig. 24 *Conchoecia obtusa* sp. nov. ♀♀, lateral and ventral carapace outlines: A, Station 7406 haul 14; B, 7406 haul 32; C–E, 7406 haul 25; F, 7856 haul 20; G–M, 7856 haul 2; N, P–R, 8272; O, 8263, S–Y, 7089 haul 29. Scale 1·0 mm.

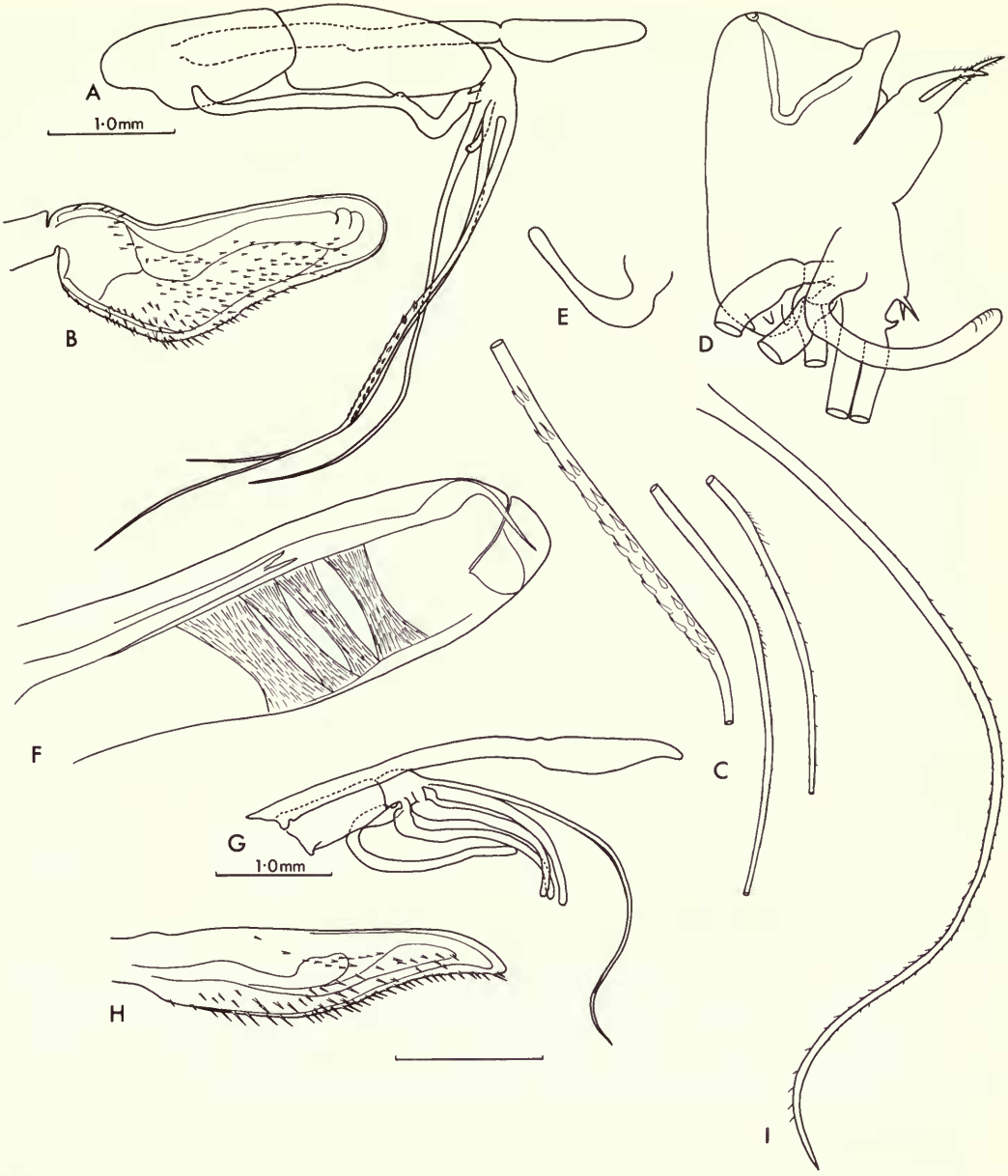

Fig. 25 *Conchoecia obtusa* sp. nov. male and female dimorphic parts, A, C, F, holotype BM(NH) reg. no. 1979.700; G–I, paratype BM(NH) reg. no. 1979.701: A, ♂ first antenna; B, ♂ frontal organ capitulum; C, ♂ first antenna b, d, e setae armatures; D, ♂ second antenna, right endopodite; E, left hook appendage; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum; I, ♀ first antenna e seta. Scales 0·05 mm except where stated otherwise.

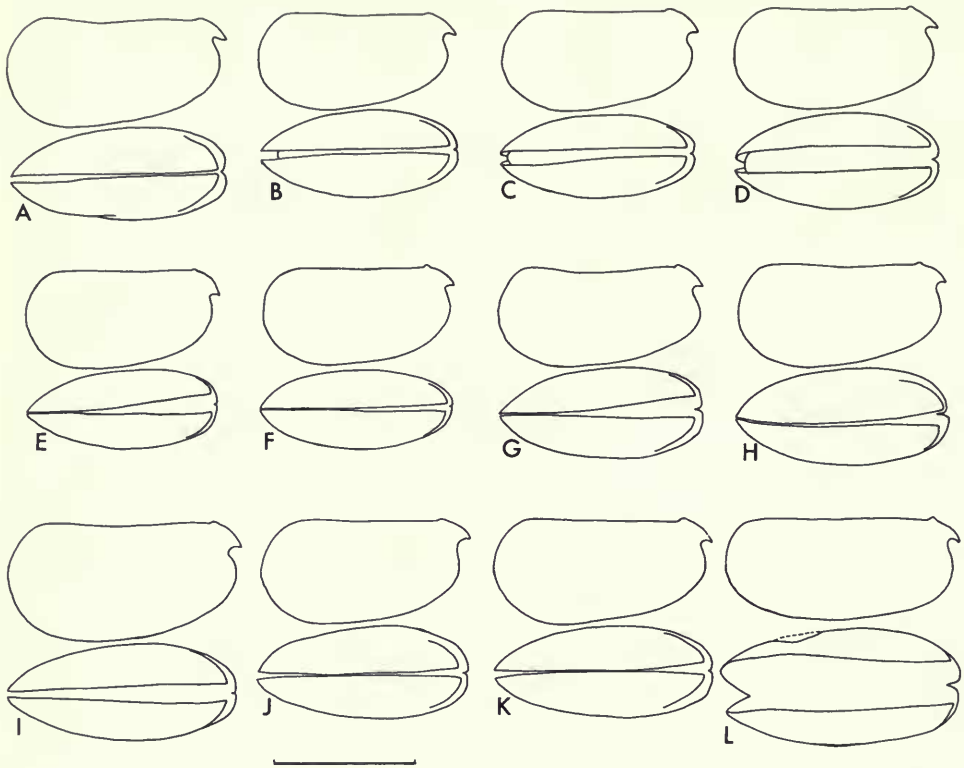

Fig. 26 *Conchoecia skogsbergi* ♂♂, lateral and ventral carapace outlines: A, holotype, NR Stockholm reg. no. 3101; B–D, small form, *Gauss* Station 27.3.03, Southern Ocean ZM Berlin reg. no. 26467; E, F, small form, *Discovery* Station 2501, SE Atlantic; G, H, intermediate form, *Discovery* Station 1776, SE Atlantic; I, large form, *Discovery* Station 1781, SE Atlantic; J, K, intermediate form, *Gauss* Station 18.21.01, SW Indian Ocean, ZM Berlin reg. no. 26467; L, *Discovery* Station 6665, haul 38, NE Atlantic, a rather damaged specimen. Scale 1·0 mm.

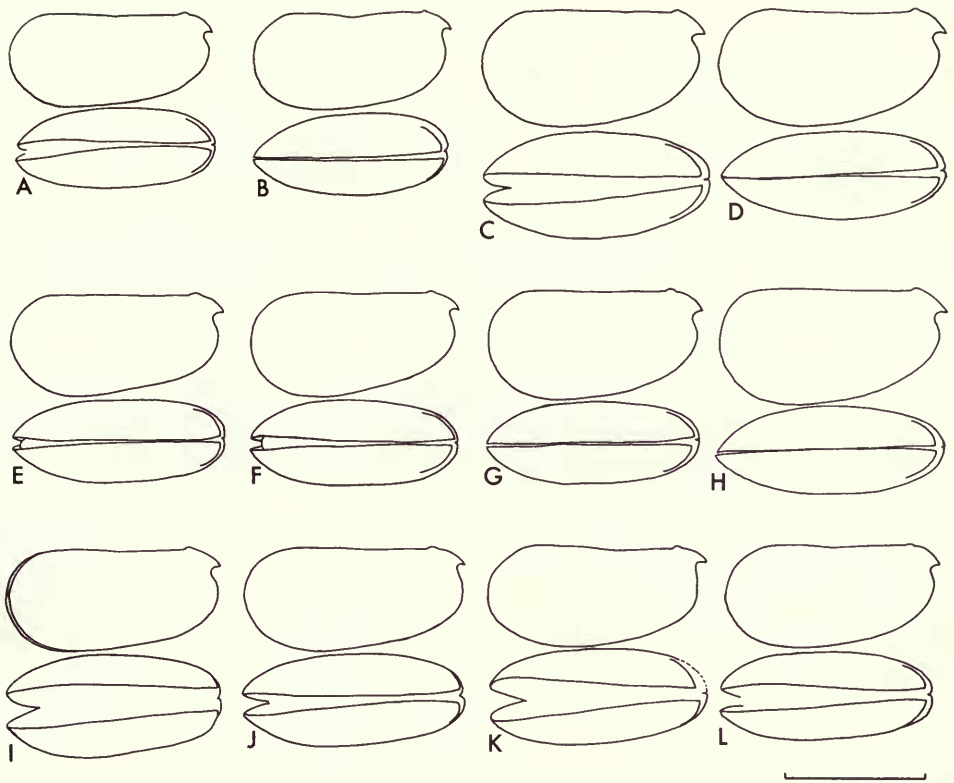

Fig. 27 *Conchoecia skogsbergi* ♀♀, lateral and ventral carapace outlines: A, paratype, NR Stockholm reg. no. 3101; B, small form, *Discovery* Station 2393; C, large form, *Discovery* Station 1782; D, large form, *Discovery* Station 1784; E–G, small form, *Gauss* Station 18.12.01, SW Indian Ocean, ZM Berlin reg. no. 26467; H, intermediate form, same station, ZM Berlin reg. no. 26467; I, small form, *Gauss* Station 12.11.01, SW Atlantic, ZM Berlin reg. no. 26479; J, intermediate form, same station, ZM Berlin reg. no. 26479; K, *Discovery* Station 6665 haul 38, NE Atlantic; L, central Arctic Ocean, BM(NH) reg. no. 1979.711. Scale 1·0 mm.

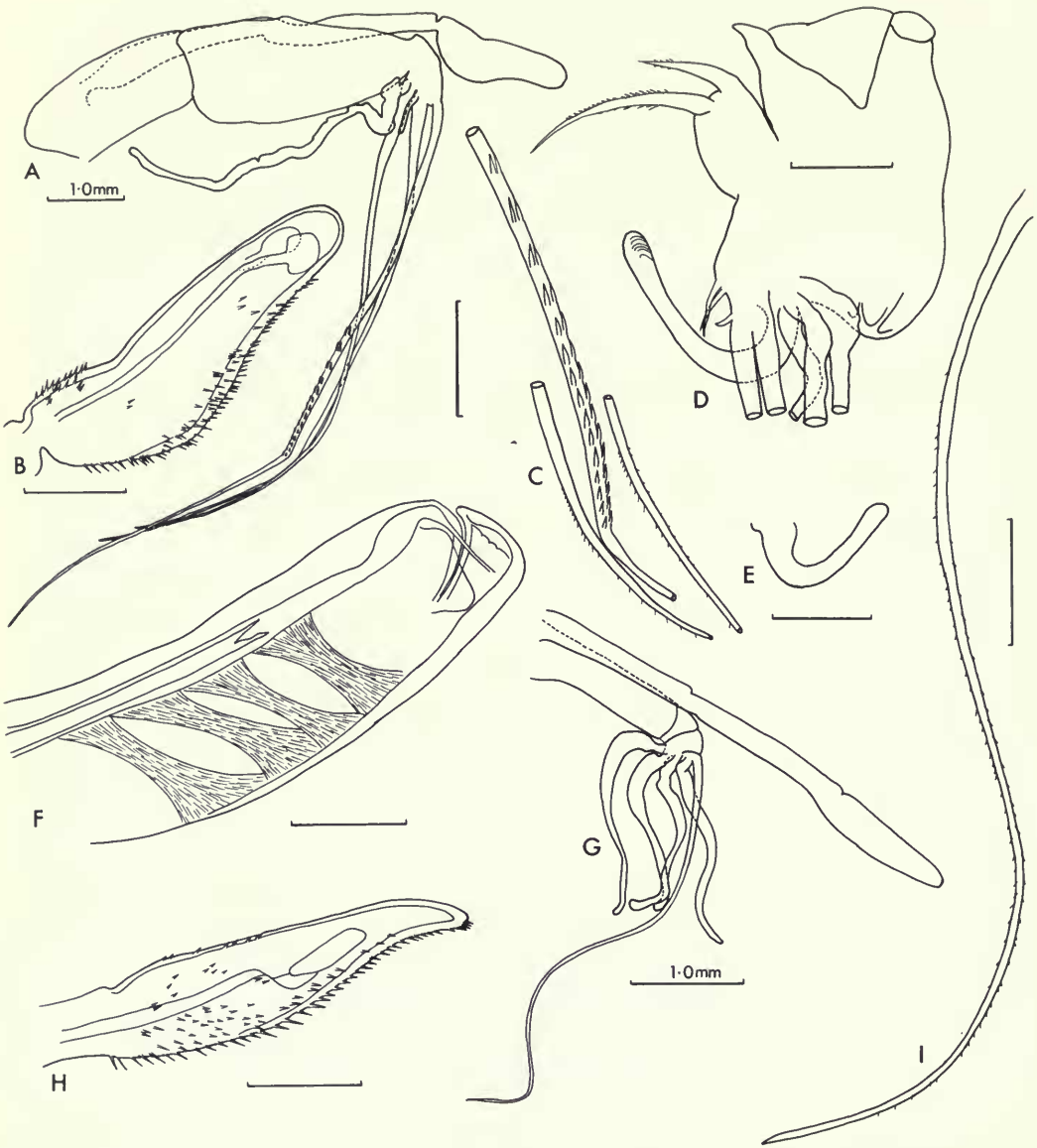

Fig. 28 *Conchoecia skogsbergi,* male and female dimorphic parts, B, C, F, BM(NH) reg. no. 1979.713: A, ♂ first antenna; B, ♂ frontal organ capitulum; C, ♂ first antenna b, d, e setae armatures; D, ♂ second antenna, right endopodite; E, left hook appendage; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum; I, ♀ first antenna e seta. Scale 0·05 mm except where stated otherwise.

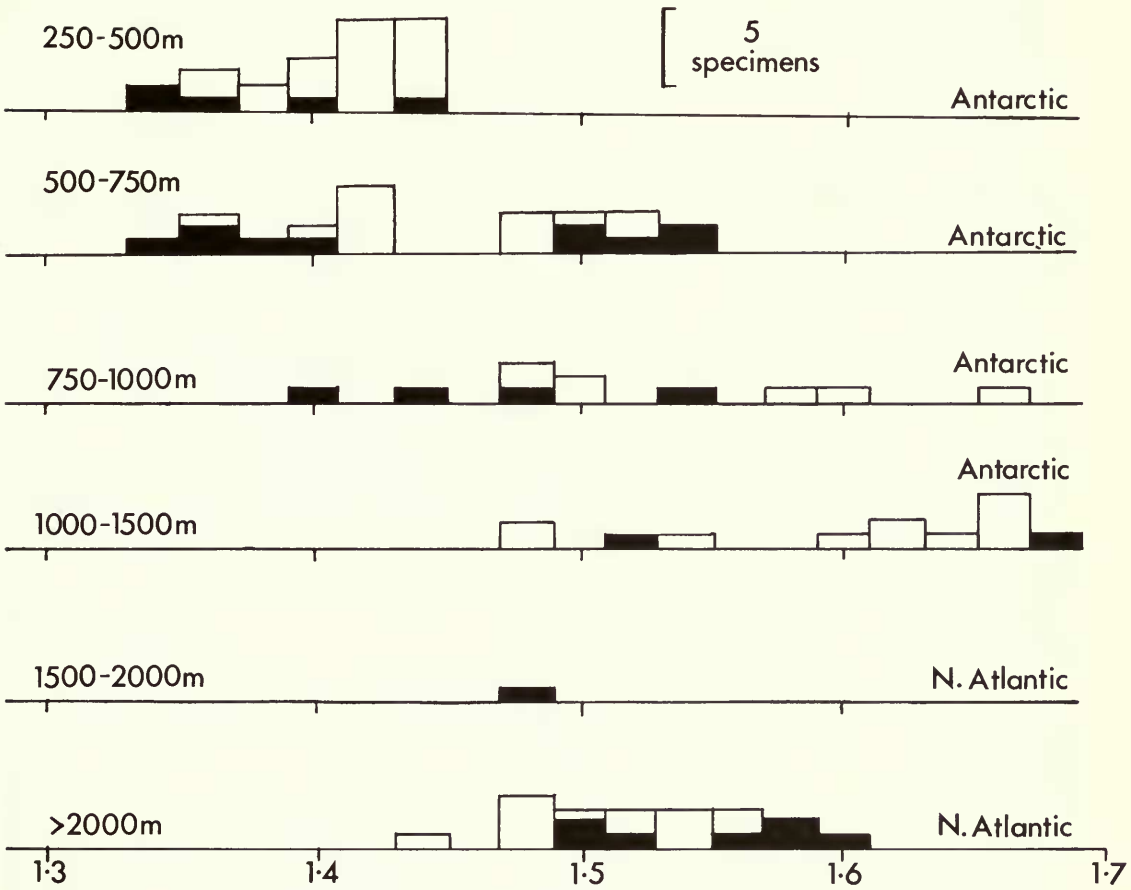

Fig. 29 *Conchoecia skogsbergi.* Carapace lengths in mm, plotted against water depth in the Southern Ocean and NE Atlantic. Males are black, females are white.

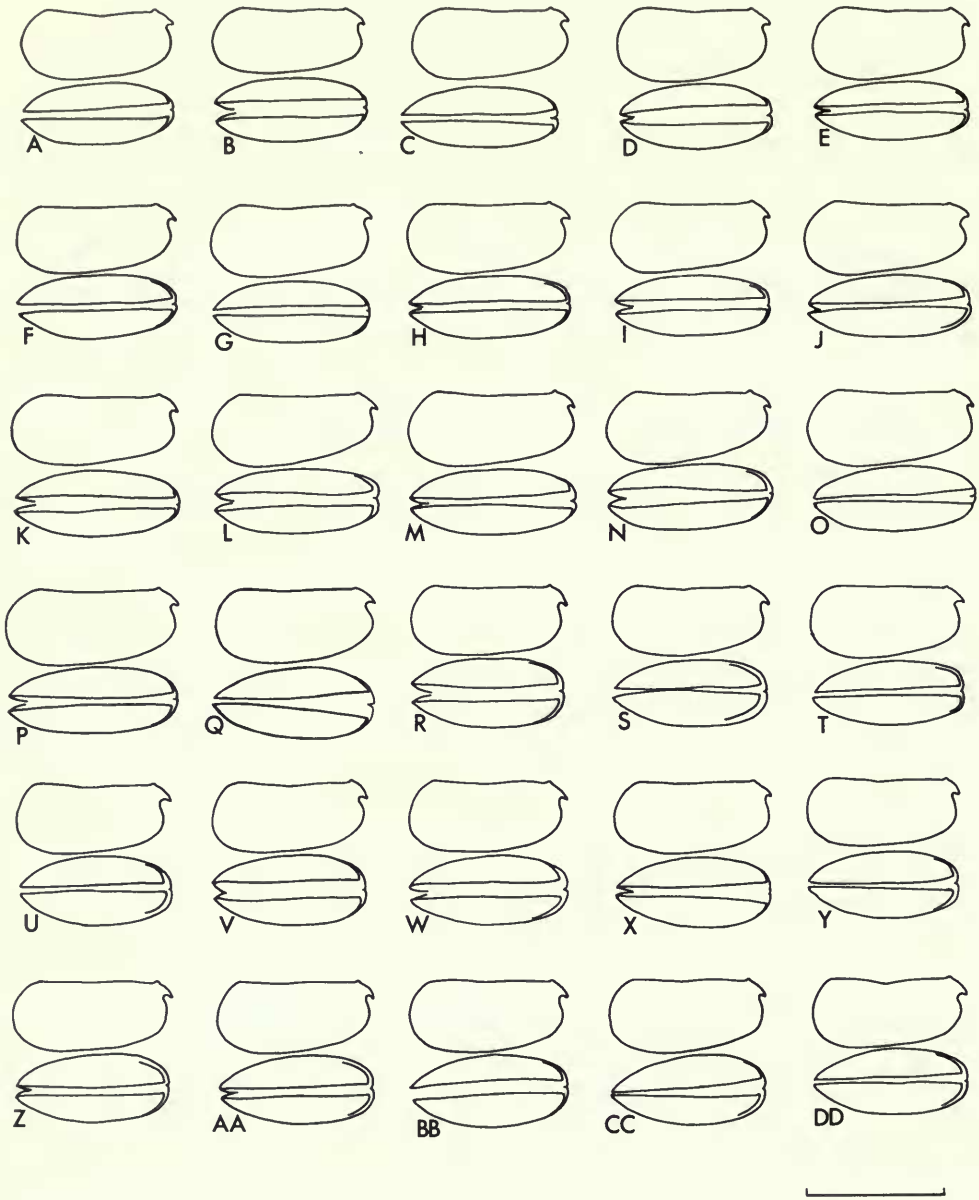

Fig. 30 *Conchoecia wolferi* sp. nov. lateral and ventral carapace outlines, A–P, ♀♀; Q–DD, ♂♂: A, B, G, Station 7089 haul 17; C, D, F, H, 7089 haul 22; E, 7089 haul 24; I, K–P, 6665 haul 4; J, 6665 haul 8; Q, R, T, V, W, 7089 haul 24; S, U, 7089 haul 10; X–Z, 6665 haul 8; AA–DD, 6665 haul 4. Scale 1·0 mm.

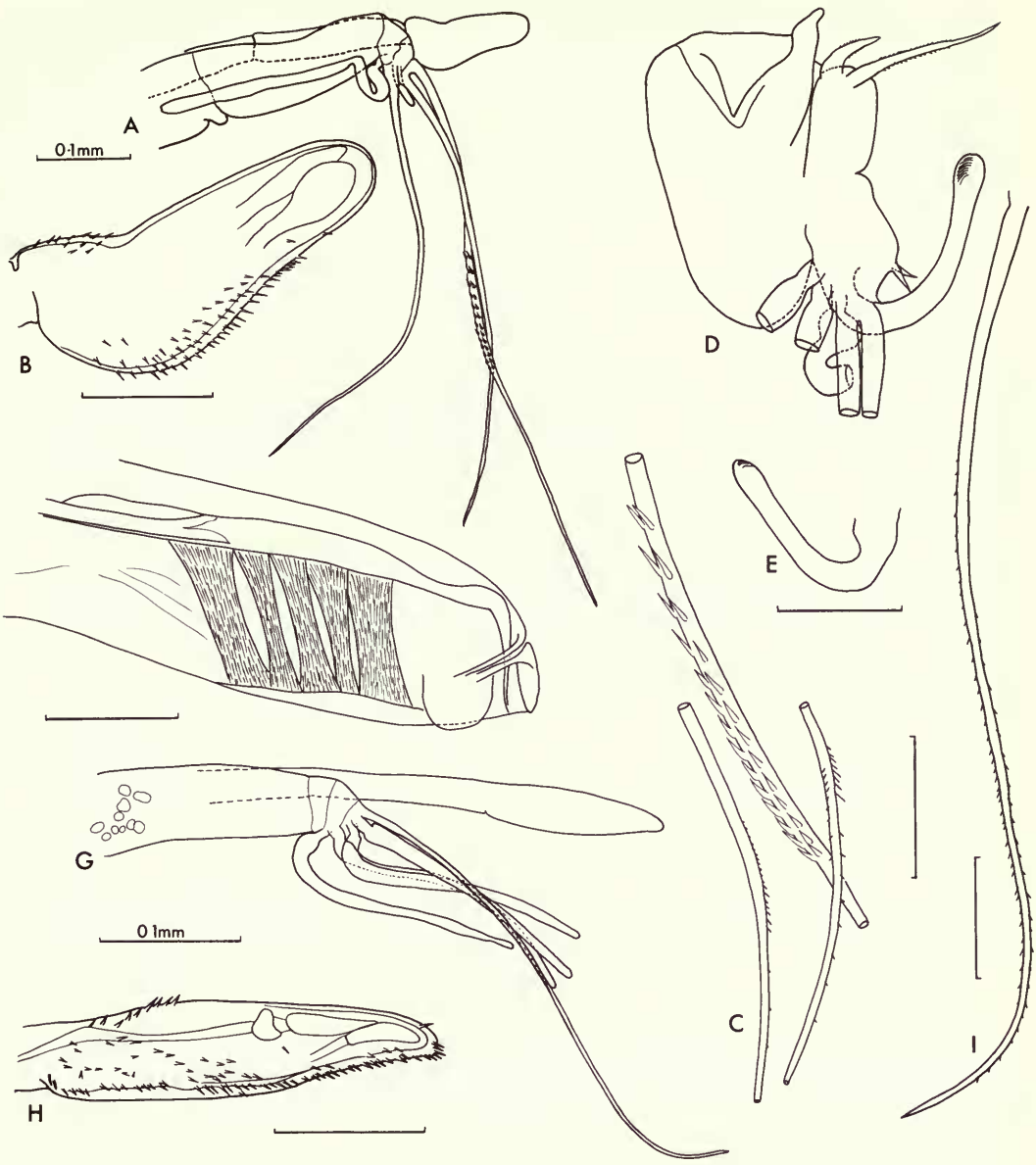

Fig. 31 *Conchoecia wolferi* sp. nov. male and female dimorphic parts, A–D, F, holotype BM(NH) reg. no. 1979.704; G–I, paratype BM(NH) reg. no. 1979.705: A, ♂ first antenna; B, ♂ frontal organ capitulum; C, ♂ first antenna, b, d, e setae armatures; D, ♂ second antenna; right endopodite; E, left hook appendage; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum; I, ♀ first antenna e seta. Scales 0·05 mm except where scale otherwise.

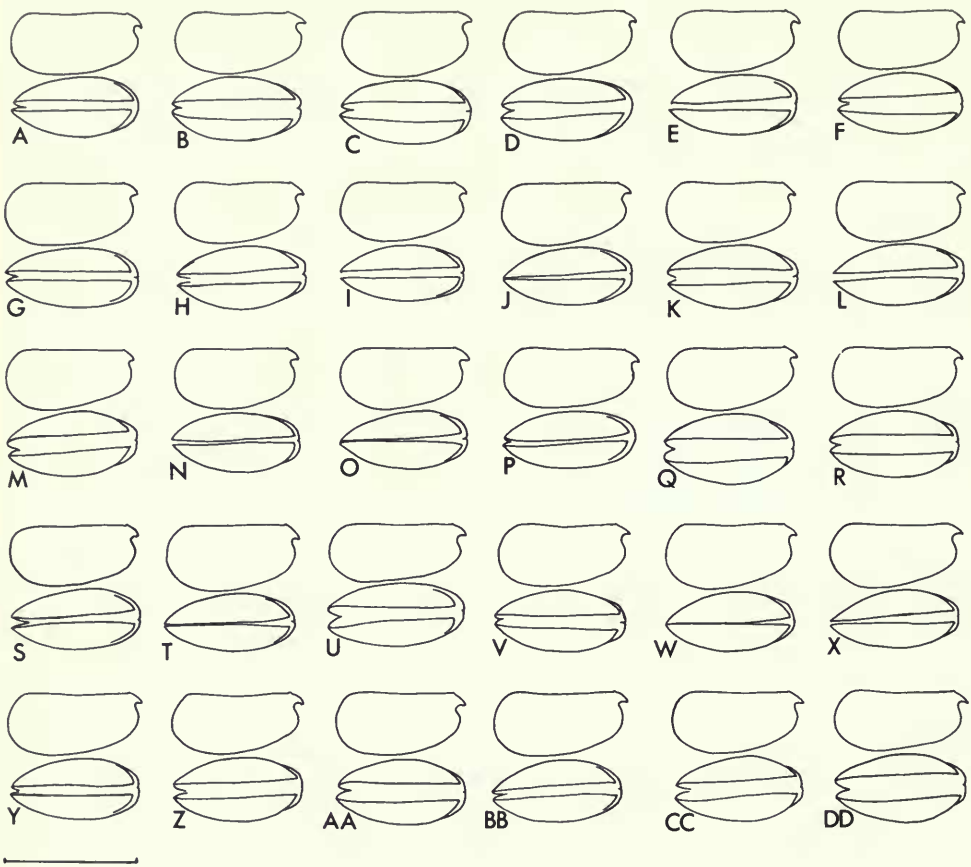

Fig. 32 *Conchoecia acuta* sp. nov. ♂♂, lateral and ventral carapace outlines: A–D, G, Station 7856 haul 22; E, F, 7856 haul 17; H, I, 8270; J–L, 8264; M, 8272; N–V, 7089 haul 19; W, Y, BB, 6665 haul 5; X, Z, CC, 6665 haul 1; AA, DD, 6665 haul 31. Scale 1·0 mm.

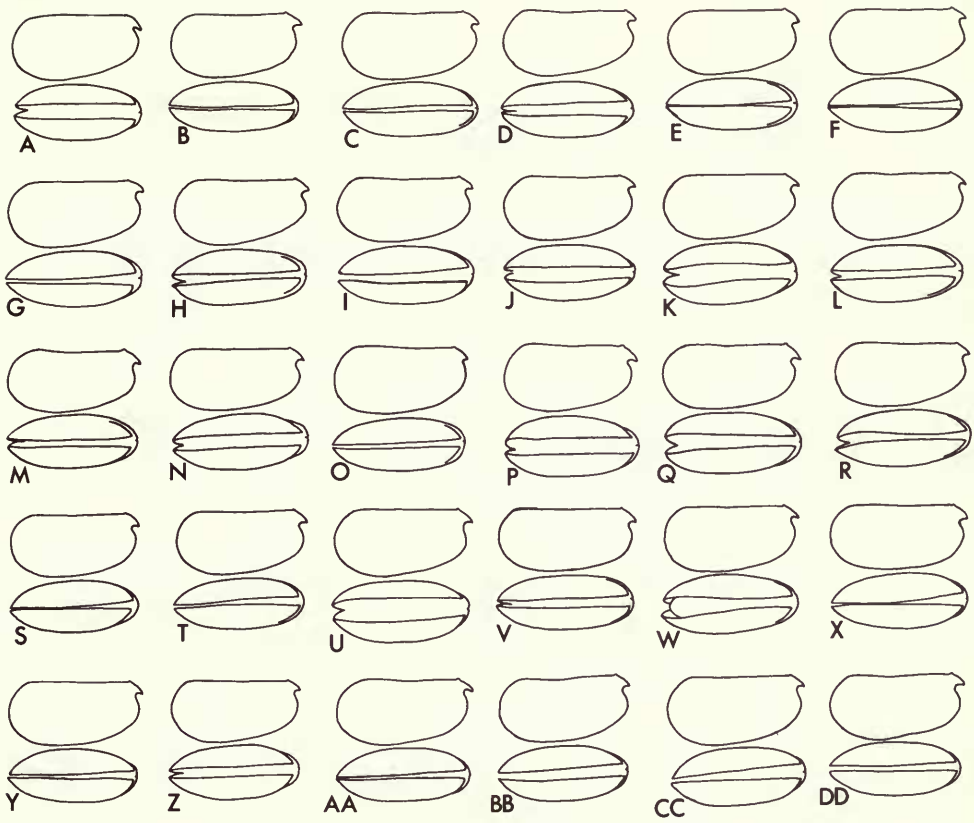

Fig. 33 *Conchoecia acuta* sp. nov. ♀♀, lateral and ventral carapace outlines: A, B, D, Station 7856, haul 19; C, E–J, 7856 haul 22; K, 7856 haul 17; L, P, Q, 7856 haul 18; M, S–X, 7089 haul 19; N, 8271; O, 8270; R, 8272; Y, Z, BB, 6665 haul 1; AA, 6665 haul 3; CC, 6665 haul 5; DD, 6665 haul 36. Scale 1·0 mm.

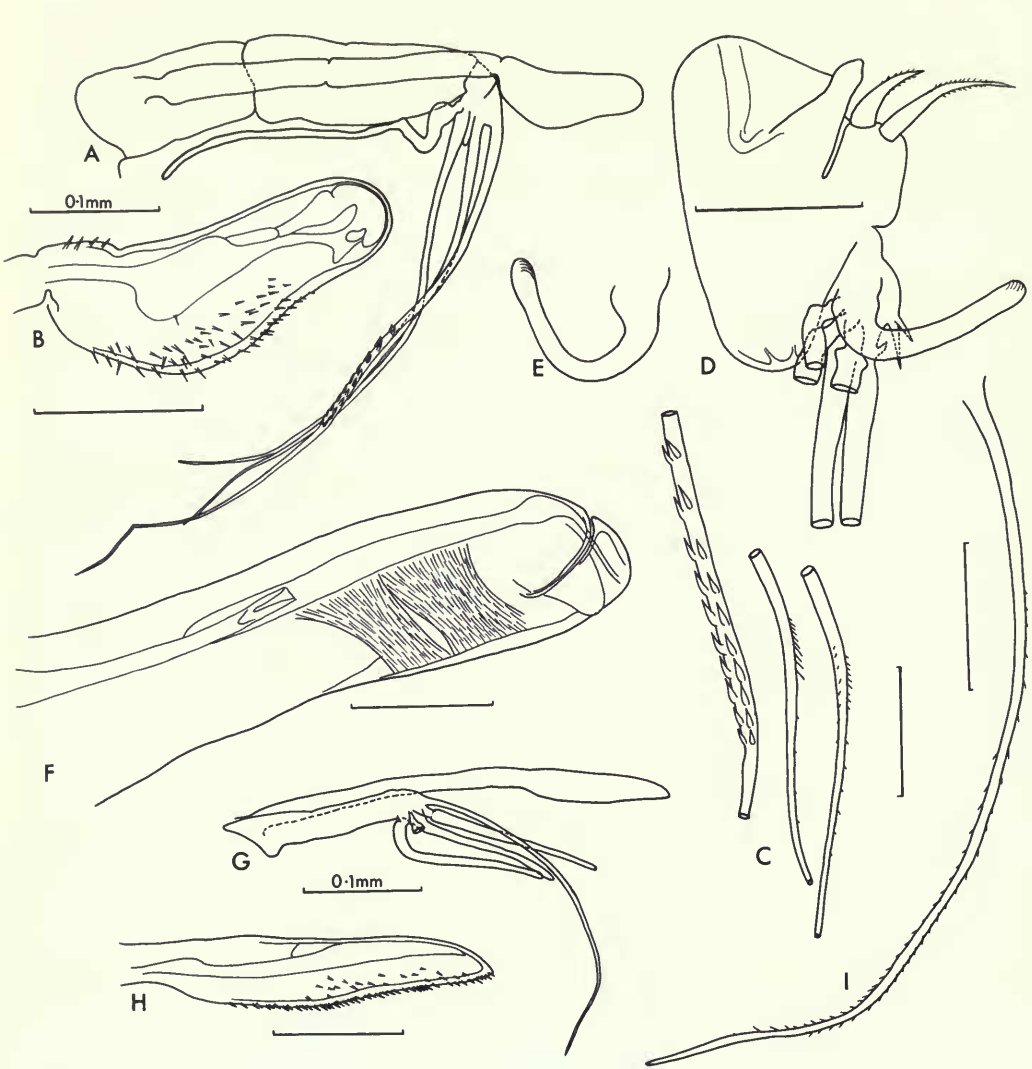

Fig. 34 *Conchoecia acuta* sp. nov., male and female dimorphic parts, A, B, D, E, holotype BM(NH) reg. no. 1979.690; G–I paratype BM(NH) reg. no. 1979.691: A, ♂ first antenna; B, ♂ frontal organ capitulum; C, ♂ first antenna b, d, e setae armatures, paratype BM(NH) reg. no. 1979.692; D, ♂ second antenna, left endopodite; E, right hook appendage; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum; I, ♀ first antenna e seta. Scale 0·05 mm except where stated otherwise.

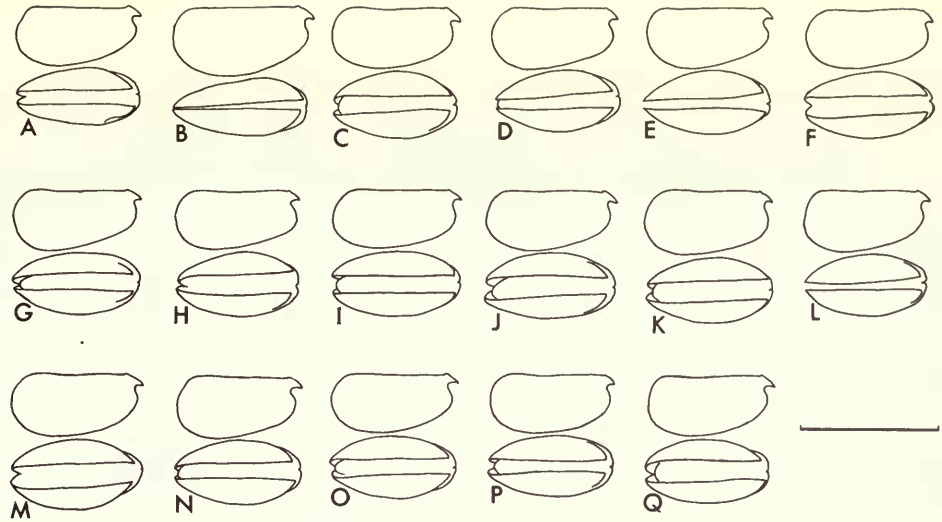

Fig. 35 *Conchoecia* aff. *acuta* ♂♂, lateral and ventral carapace outlines, A, B, narrow form; C–Q, broad form: A, *Dana* Station 3625–2; B, 3623–2; C–E, 3613–10; F, 3623–5; G, H, 3624–2; I, 3624–4; J–L, N, 3624–8; M, 3624–5; O–Q, 3625–2. Scale 1·0 mm.

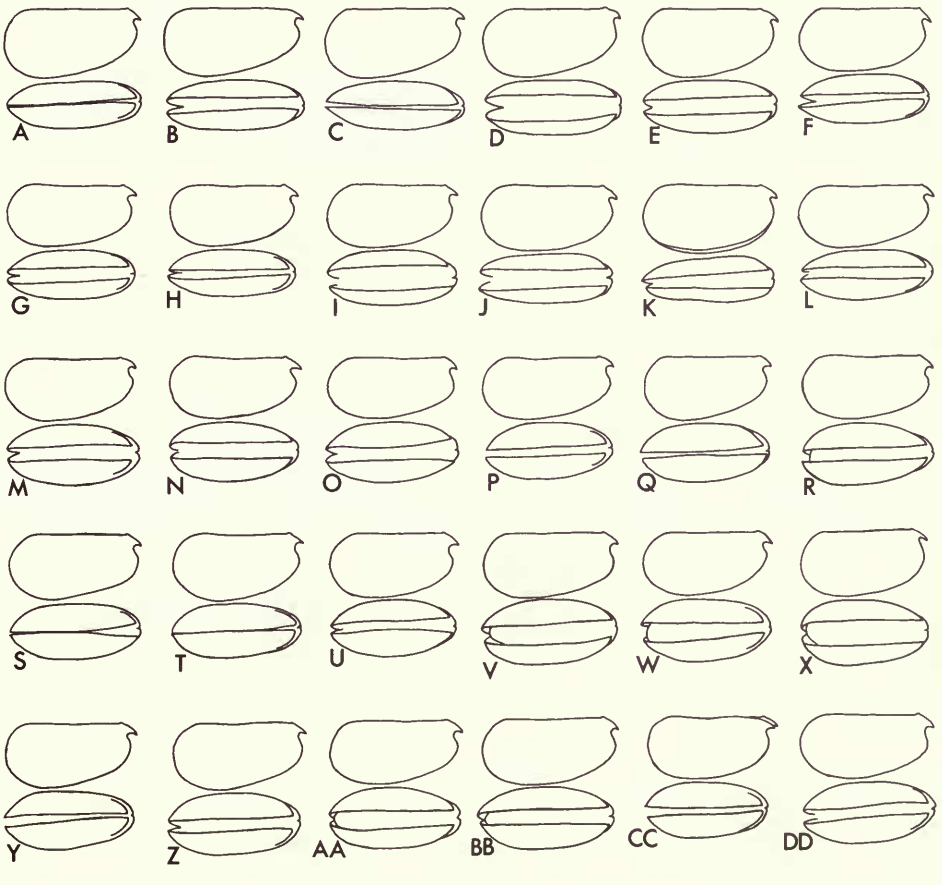

Fig. 36 *Conchoecia* aff. *acuta,* ♀♀ lateral and ventral carapace outlines, A–L, narrow form; M–DD, broad form: A, D, *Gauss* Station 26.10.01 ZM Berlin reg. no. 26474; B, C, 5.11.01a; E, R, W, DD, *Dana* Station 3625–2; F, I, J, U, V, X, 3624–5; G, H, M, N, 3613–3; K, L, O, P, 3613–10; Q–S, 3624–2; T, 3624–4; Y–CC, 3624–8. Scale 1·0 mm.

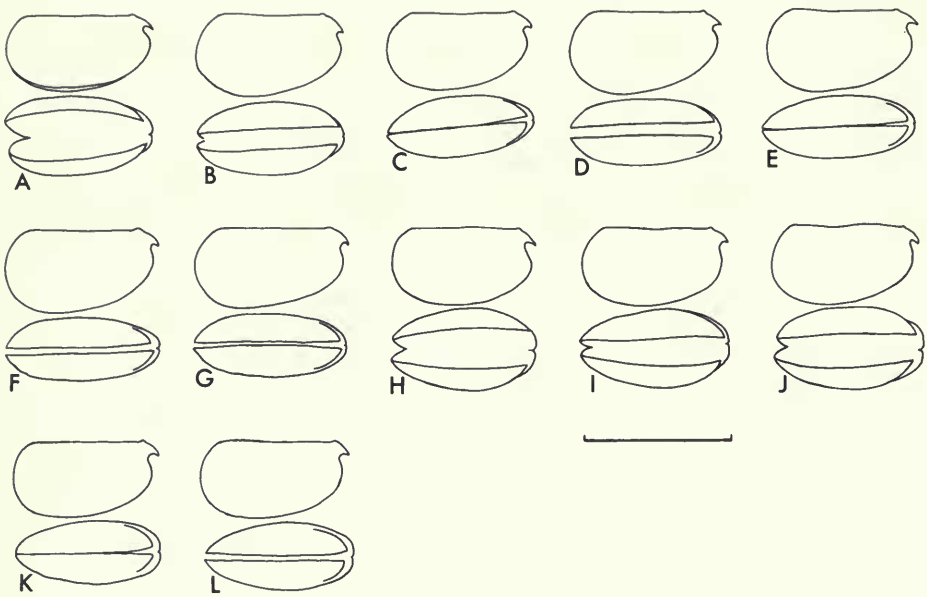

Fig. 37 *Conchoecia australis* sp. nov., lateral and ventral carapace outlines, A–G, ♀♀; H–L, ♂♂: A, *Discovery* Station 2026, paratype BM(NH) reg. no. 1979.775; B, S.A.E. Station 66b, NR Stockholm reg. no. 237; C–G, *Gauss* Station 18.12.01, ZM Berlin reg. no. 26468; H, I, *Discovery* Station 2026, paratypes BM(NH) reg. nos. 1979.776, 777; J, S.A.E. Station 65b, NR Stockholm reg. no. 236; K, L, *Gauss* Station 18.12.01, ZM Berlin reg. no. 26468. Scale 1·0 mm.

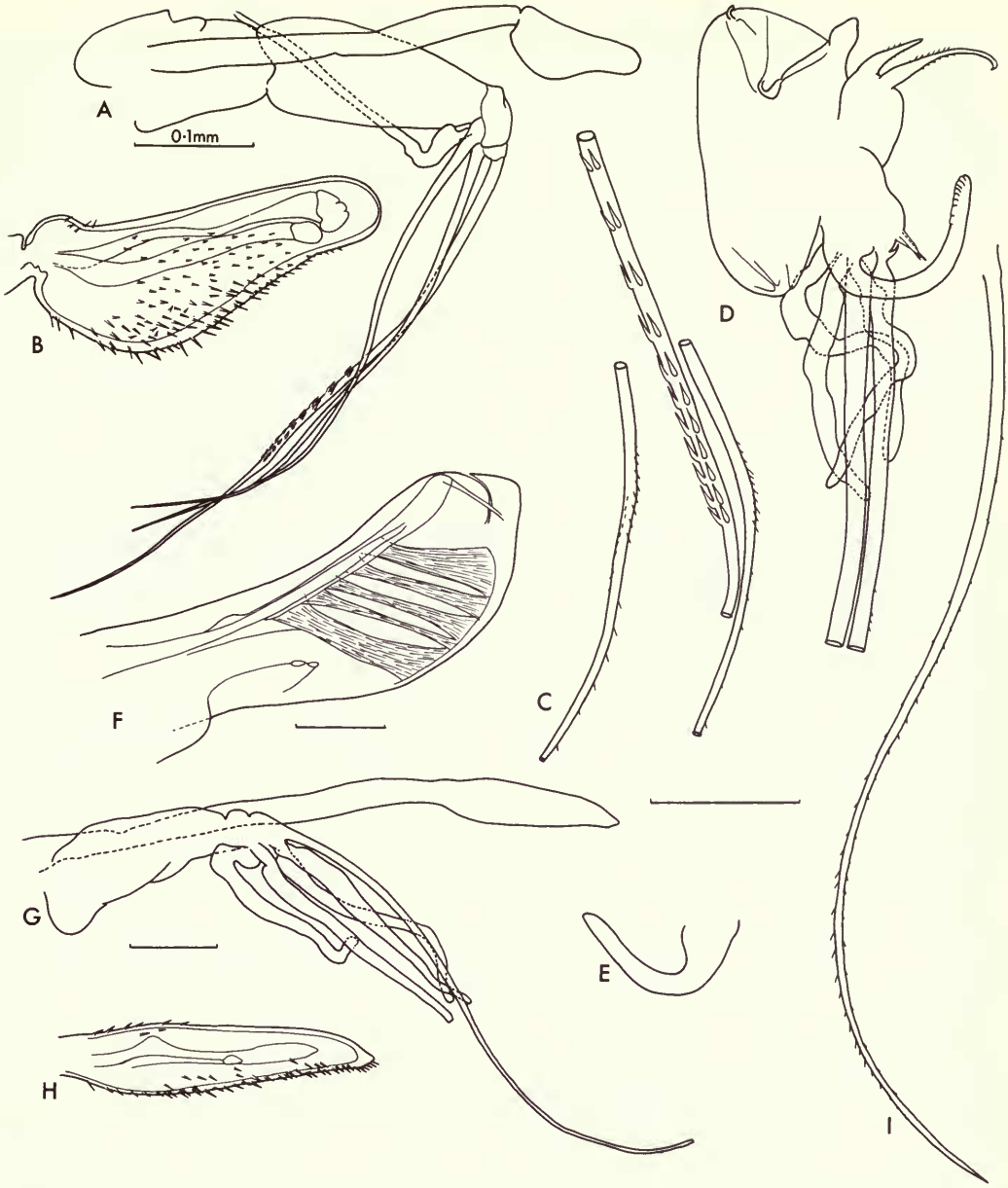

Fig. 38 *Conchoecia australis* sp. nov., male and female dimorphic parts, G–I, paratype BM(NH) reg. no. 1980.142: A, ♂ first antenna, paratype BM(NH) reg. no. 1980.143; B, ♂ frontal organ capitulum, paratype BM(NH) reg. no. 1980.144; C, ♂ first antenna b, d, e setae armatures, paratype BM(NH) reg. no. 1980.145; D, second antenna, right endopodite, holotype BM(NH) reg. no. 1980.141; E, left hook appendage, paratype BM(NH) reg. no. 1980.145; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum, I, first antenna e seta. Scale 0·05 mm except where stated otherwise.

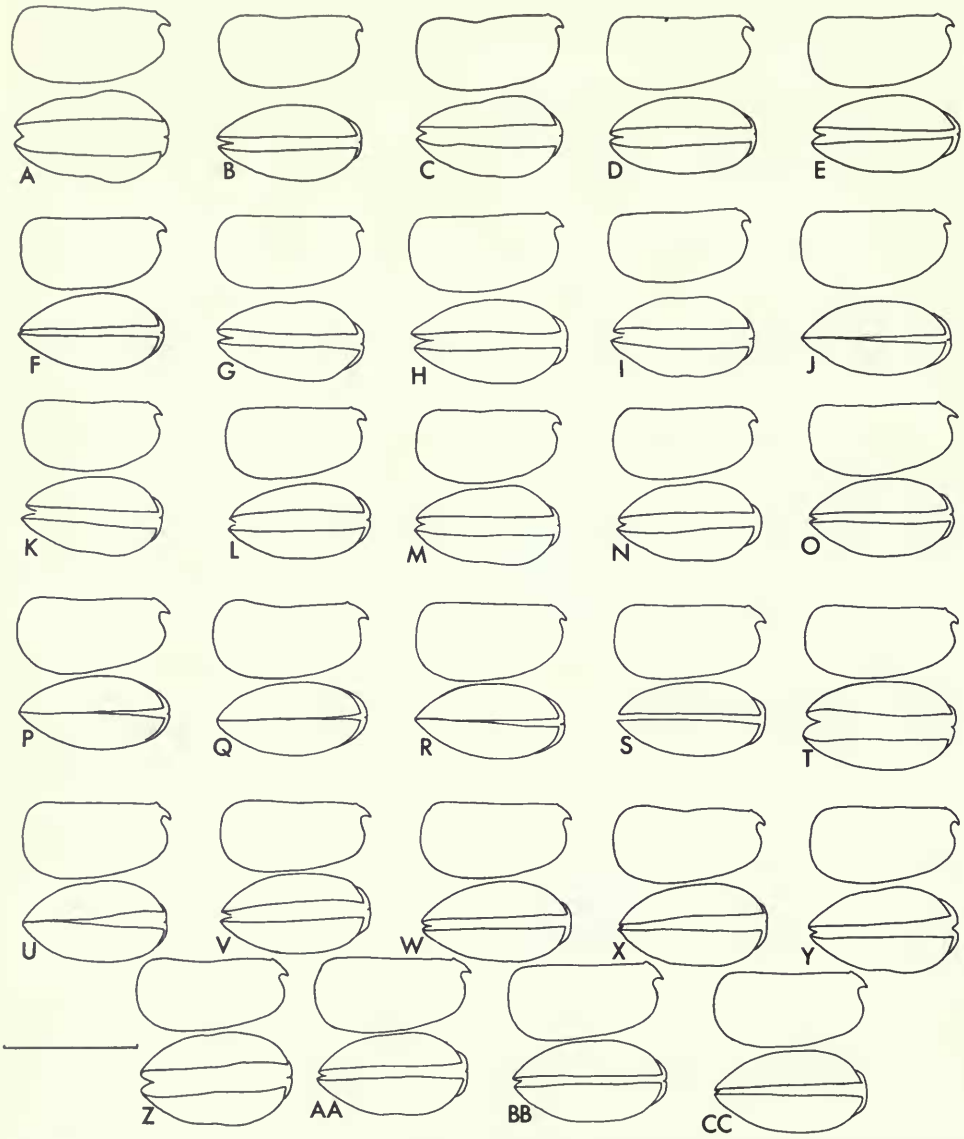

Fig. 39 *Conchoecia inflata* sp. nov. ♂♂, lateral and ventral carapace outlines; A, Station 7711 haul 23; B, I, 7856 haul 15; C, 7406 haul 26; D, E, G, 7406 haul 38; F, H, 7406 haul 2; J, P–R, 7089 haul 29; K, L, O, 7089 haul 21; M, S, T, 7089 haul 11; N, 7089 haul 4; U, Y, BB, 6665 haul 4; V, 6665 haul 6; W, X, Z, AA, CC, 6665 haul 7. Scale 1·0 mm.

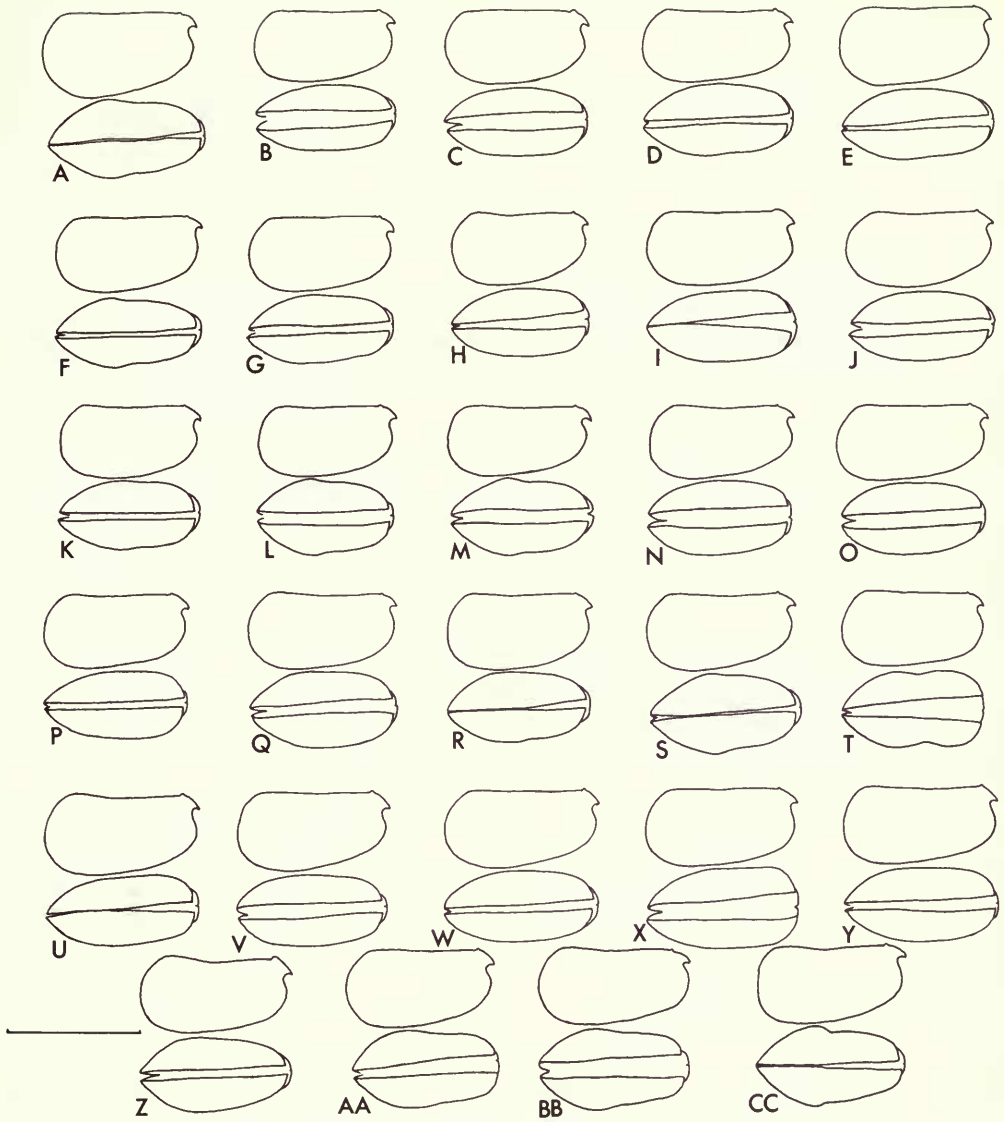

Fig. 40 *Conchoecia inflata* sp. nov. ♀♀, lateral and ventral carapace outlines: A, Station 7711 haul 23; B, C, F, 7406 haul 38; D, E, 7406 haul 2; G, L, 7856 haul 15; H, I, K, M, N, 7856 haul 21; J, 7856 haul 17; O, 7089 haul 29; P–S, 7089 haul 25; T, 7089 haul 11; U, V, Y, 6665 haul 7; W, X, CC, 6665 haul 3; 6665 haul 21; AA, 6665 haul 32; BB, 6665 haul 2. Scale 1·0 mm.

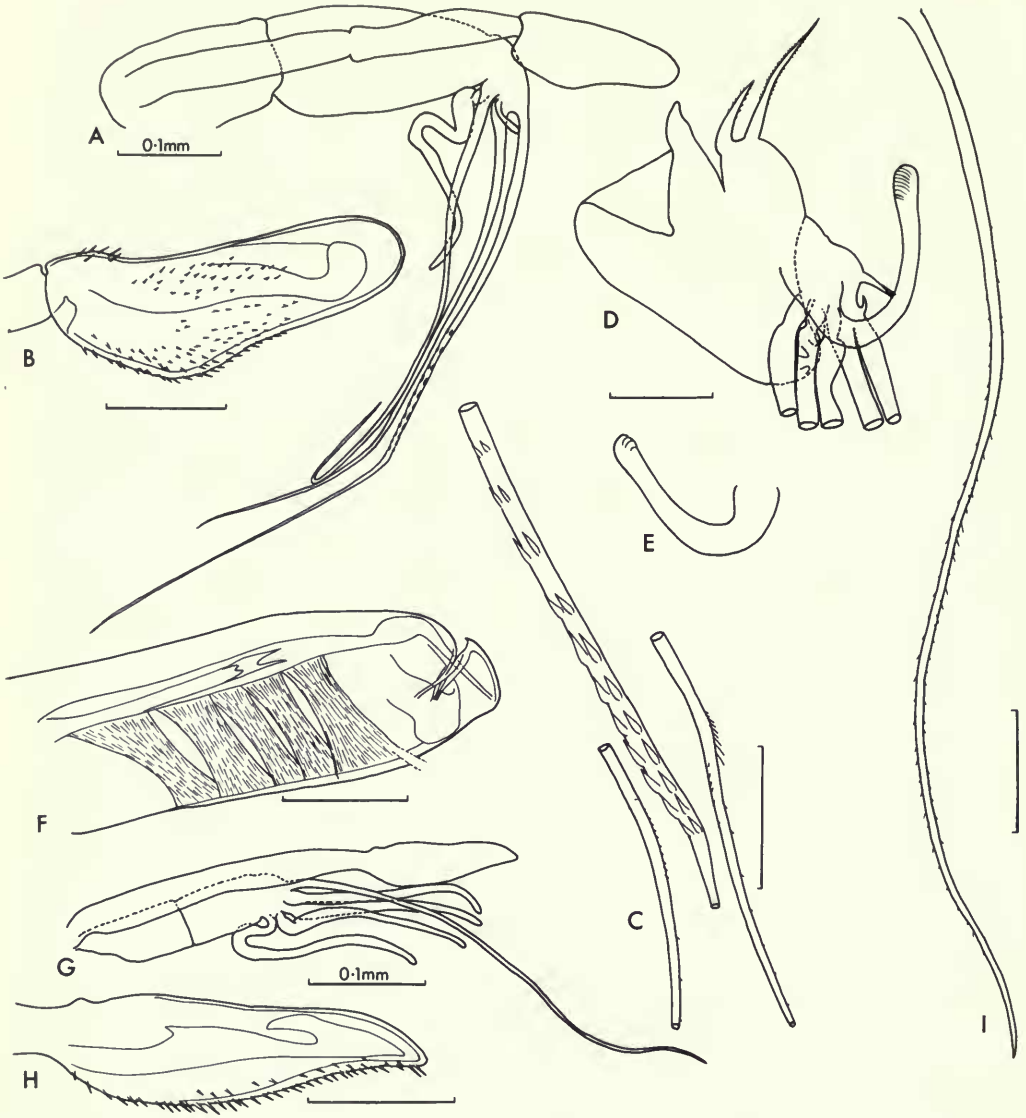

Fig. 41 *Conchoecia inflata* sp. nov., male and female dimorphic parts, A, C, D, F, holotype BM(NH) reg. no. 1979.698; E–G, paratype BM(NH) reg. no. 1979.699: A, ♂ first antenna; B, ♂ frontal organ capitulum; C, ♂ first antenna, b, d, e setae armatures; D, ♂ second antenna, right endopodite; E, left hook appendage; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum; I, ♀ first antenna e seta. Scales 0·05 mm except where stated otherwise.

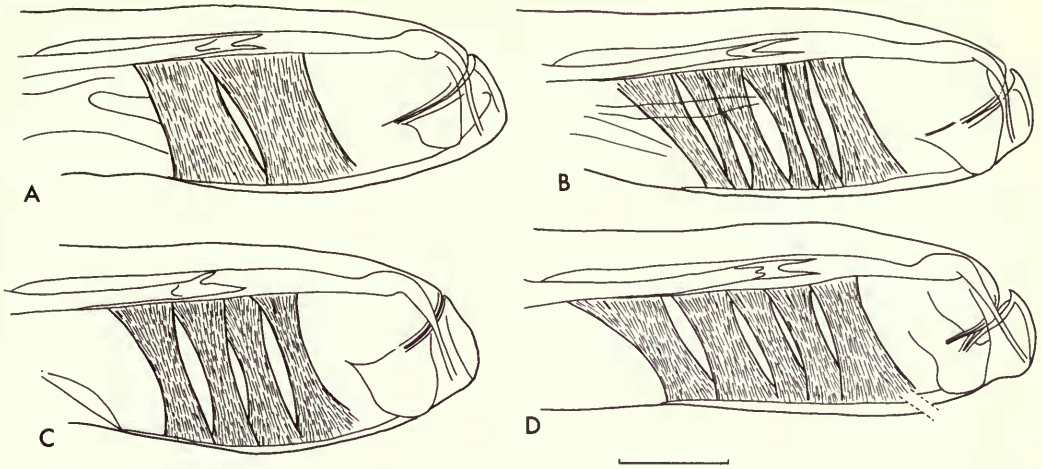

Fig. 42 *Conchoecia inflata* sp. nov., variation in the number of transverse penis muscles: A, B, Station 7856 haul 17; C, 6665 haul 18; D, holotype, BM(NH) reg. no. 1979.698, 6665 haul 24. Scale 0·05 mm.

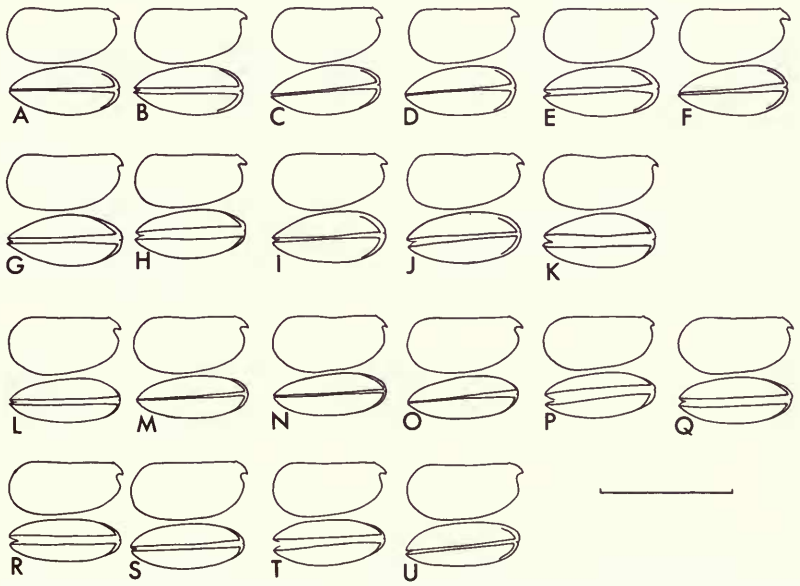

Fig. 43 *Conchoecia rotundata* lateral and ventral carapace outlines, A–K, ♂♂; L–U, ♀♀: A–D, F–H, M, S, U, Station 7856 haul 72; E, 7856 haul 11; I–K, 8263; L, 7856 haul 1; N, O, 8263; P–R, T, 7856 haul 18. Scale 1·0 mm.

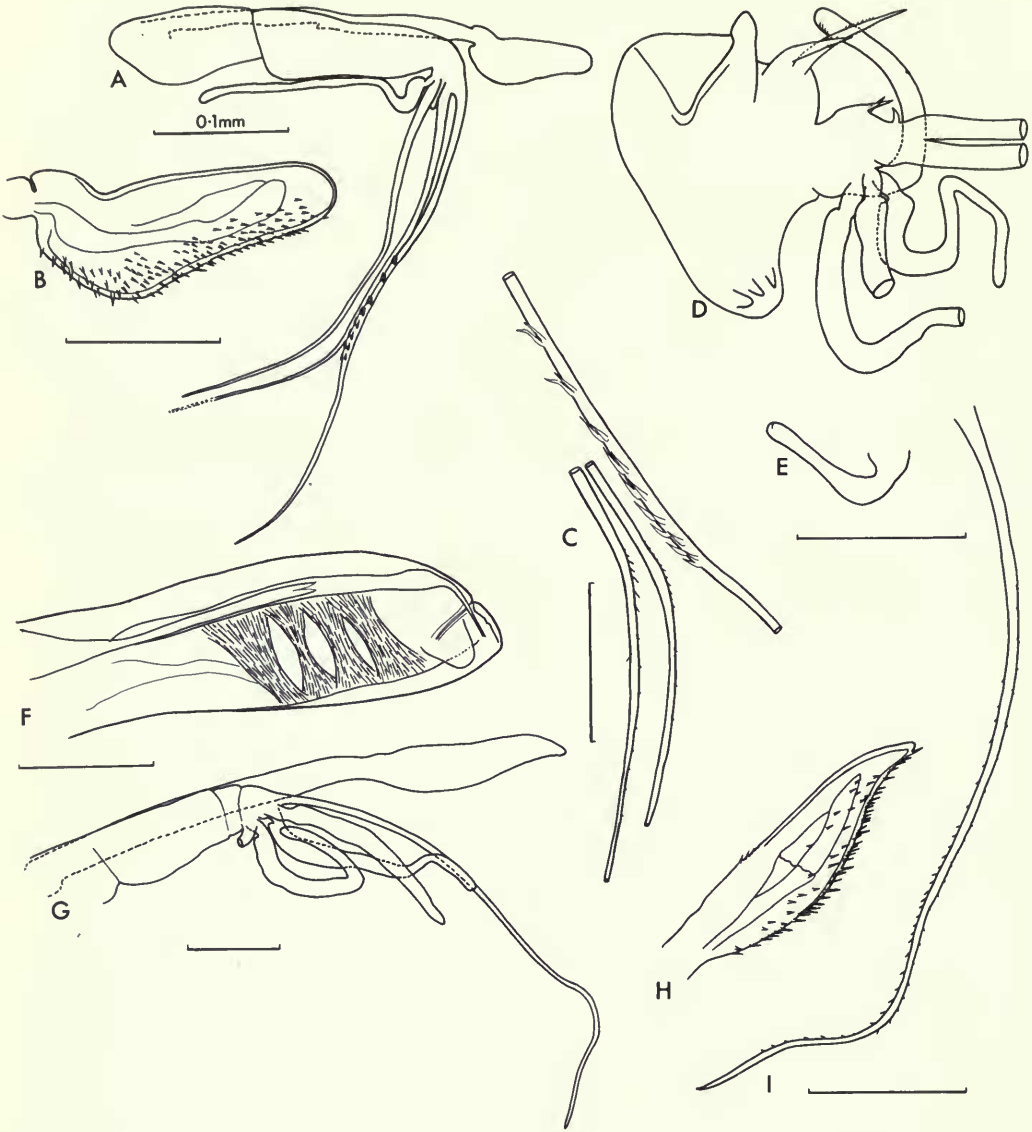

Fig. 44 *Conchoecia rotundata,* male and female dimorphic parts, A–C, BM(NH) reg. no. 1979.710; G–I, BM(NH) reg. no. 1979.710: A, ♂ first antenna; B, ♂ frontal organ capitulum; C, ♂ first antenna, b, d, e setae armatures; D, ♂ second antenna, right endopodite; E, left hook appendage; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum; I, ♀ first antenna e seta. Scales 0·05 mm except where stated otherwise.

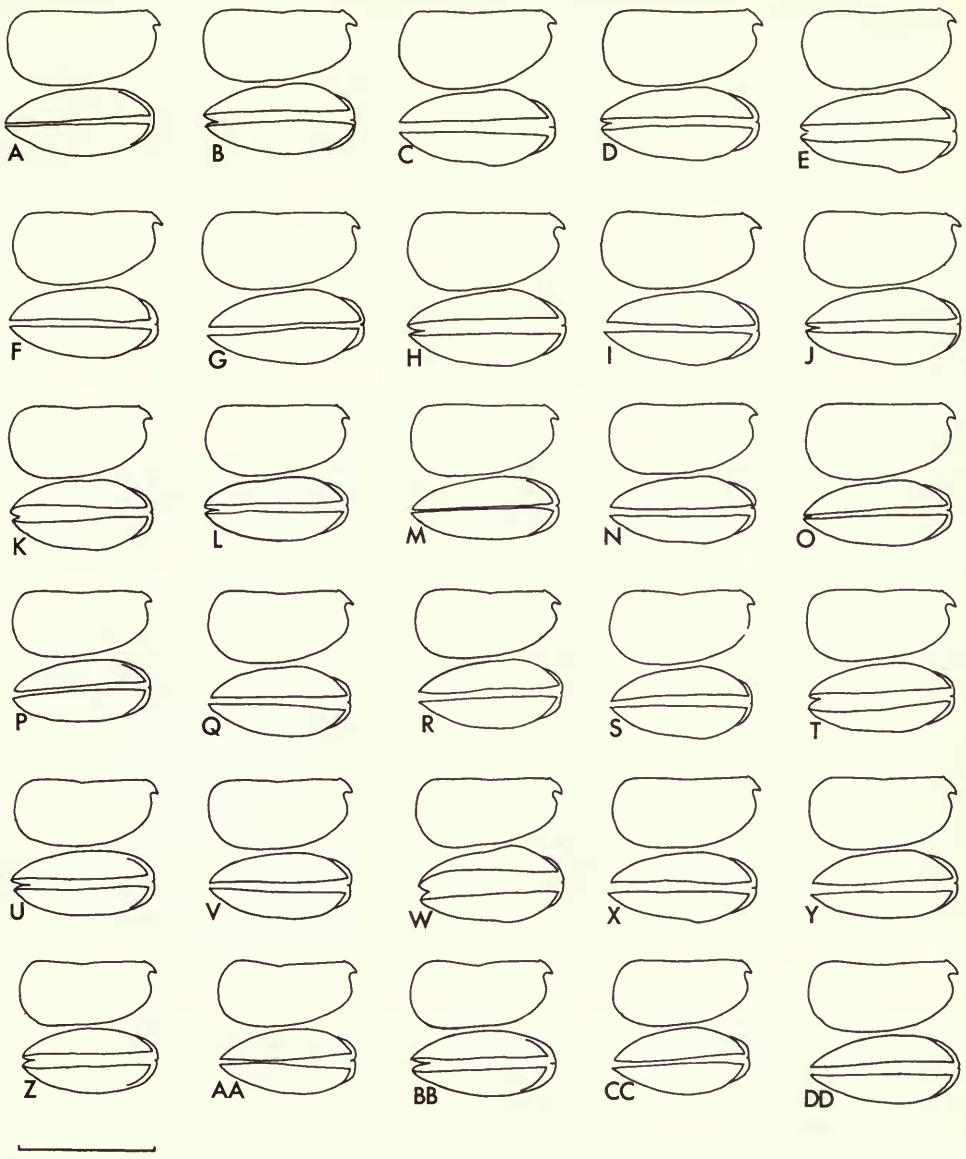

Fig. 45 *Conchoecia subinflata* sp. nov. ♂♂, lateral and ventral carapace outlines: A, Station 7709 haul 7; B–E, 7709 haul 29; F–J, 7711 haul 23; K, 7856 haul 12; L, 7406 haul 25; M–O, 7406 haul 28; P–S, 7856 haul 20; T, 7406 haul 25; U–Y, 7089 haul 29; Z, BB, CC, 6665 haul 6; AA, 6665 haul 7; DD, 6665 haul 8. Scale 1·0 mm.

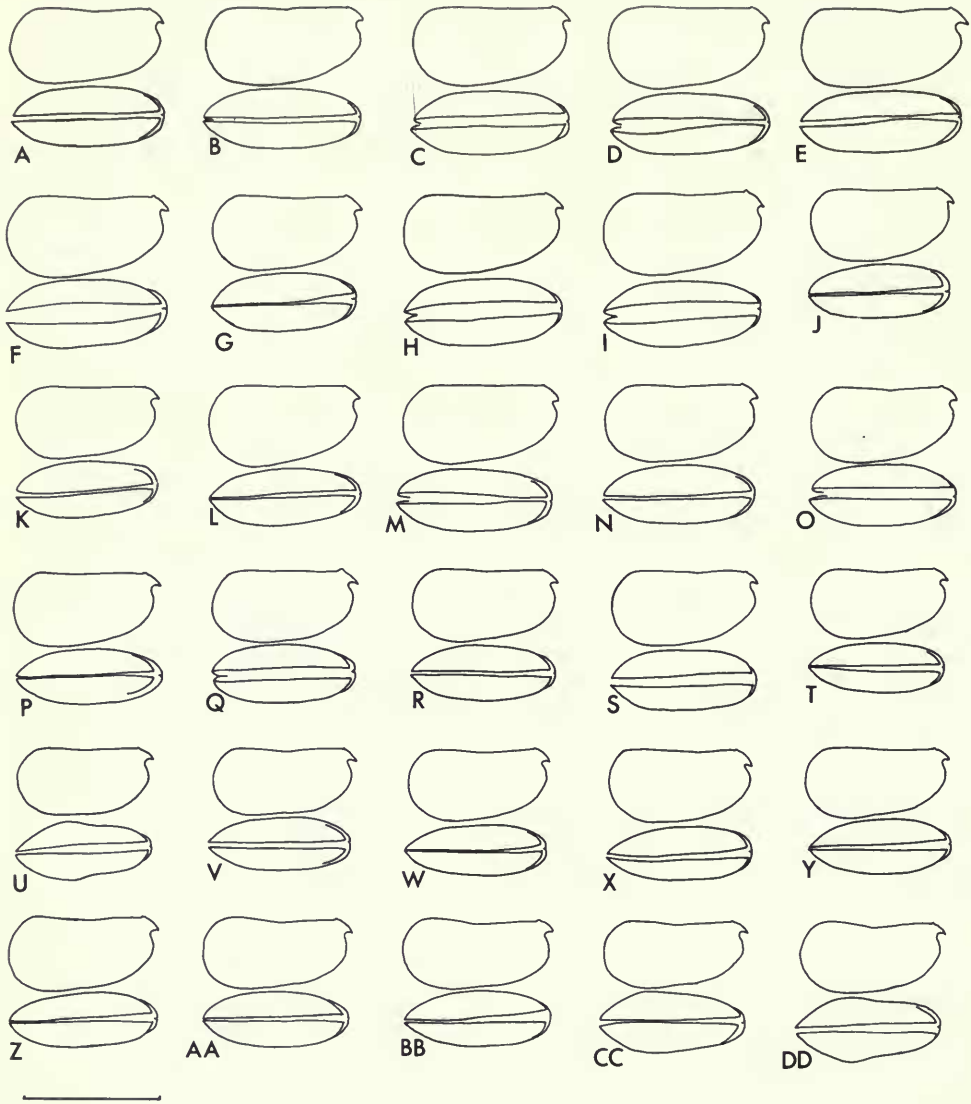

Fig. 46 *Conchoecia subinflata* sp. nov. ♀♀, lateral and ventral carapace outlines: A–B, Station 7709 haul 29; F–I, 7711 haul 23; J–L, 7406 haul 32; M, N, 7406 haul 28; O, 7856 haul 2; P, Q, 7406 haul 25; R, 7856 haul 2; S, 7856 haul 20; T, V–Y, 7089 haul 29; U, 7089 haul 28; Z, 6665 haul 13; AA, 6665 haul 6; BB, 6665 haul 4; CC, 6665 haul 7; DD, 6665 haul 8. Scale 1·0 mm.

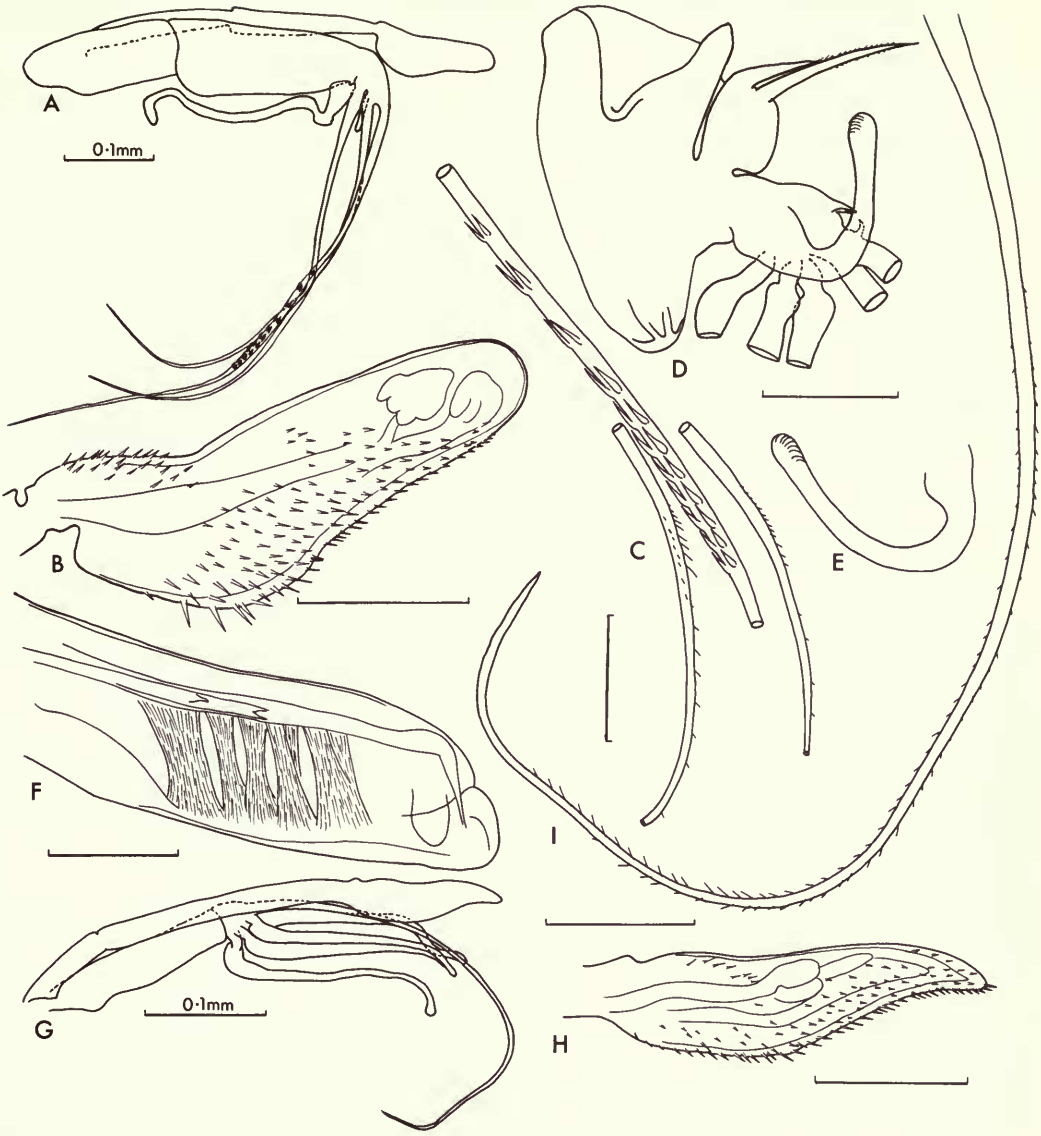

Fig. 47 *Conchoecia subinflata* sp. nov., male and female dimorphic parts, A–D, holotype, BM(NH) 1979.702; G–I, paratype BM(NH) reg. no. 1979.703: A, ♂ first antenna; B, ♂ frontal organ capitulum; C, ♂ first antenna, b, d, e setae armatures: D, ♂ second antenna, left endopodite; E, right hook appendage; F, penis; G, ♀ first antenna; H, ♀ frontal organ capitulum; I, ♀ first antenna e seta. Scales 0·05 mm except where stated otherwise.